# Student Medicine

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# Student Medicine

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# Editorial Comment

## DO WE HOSPITALIZE OUR STUDENT-PATIENTS TOO LONG AND USE ANTIBIOTICS TOO FREELY?

THE evaluation study of in-hospital care provided by the student health services of five large universities which is reported by Dr. Mary Boyer on page 126 of this issue provides material requiring considerable thought and careful consideration.

One of the more striking findings is that the average length of hospital stay for patients with infectious mononucleosis varied almost 100 per cent between the hospital reporting the shortest average stay and the one reporting the longest. In a disease with no known specific treatment this must result largely from a difference in the beliefs of the attending physicians concerning the seriousness of this disease or the deleterious effect of physical activity during its course. Those physicians who hospitalize their patients for short periods apparently believe either that the disease carries little potential for serious harm or sequelae, or that early resumption of physical activity does not prolong the period until recovery takes place and does not increase the incidence of sequelae. Those physicians who advocate longer bed rest presumably believe either that infectious mononucleosis is a serious illness with appreciable potential for sequelae or that early activity prolongs the period of disability and increases the likelihood of sequelae.

The final results of treatment of infectious mononucleosis were considered to be generally satisfactory in both hospitals. If this be true, then some university students are being needlessly kept from classes. This is important, because in our experience the longer a student is out of classes because of illness, the greater the possibility that he will be unable to complete successfully the scholastic work of the semester in which illness occurs. In this connection

we have observed that, if a patient with infectious mononucleosis is transferred to the care of his home physician, he usually does not return to classes as soon as if he had remained on campus. To many physicians in private practice who are relatively unfamiliar with it, this is a sinister disease which requires a long period of rest to insure recovery, even though the clinical course has been uncomplicated. For this reason we question the desirability of transferring patients to their homes in most instances and prefer to have them remain under the care of the university medical staff.

Early ambulation following surgery has become an accepted practice and has been used long enough to make it very unlikely that patients are being harmed by it. Perhaps early ambulation after illness also is advisable.

Chalmers *et al.*,[1] in a carefully controlled study of patients with infectious hepatitis treated in a military hospital, found that those patients allowed up and about the ward at will recovered as rapidly as did those patients kept at strict bed rest. Follow-up examinations did not show any increase in incidence of late sequelae. They further demonstrated that strenuous reconditioning activity, begun early in the convalescent stage of illness, did not cause relapse or result in an increased incidence of chronic disability or other residual abnormality, although it did in a few cases appear to cause temporary worsening of symptoms or laboratory abnormalities. These disappeared even though exercise was continued.

These results seem applicable to infectious mononucleosis because infectious hepatitis is also a disease with no specific treatment and reliance is placed on general supportive and symptomatic measures. Before a final conclusion can be reached, a similar study of patients with infectious mononucleosis must be carried out. Until such a study is reported, we feel that the available evidence favors returning students to academic classes as promptly as possible, but curtailing physical training and extracurricular activity, after illness with infectious mononucleosis in order that

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[1] T. C. Chalmers *et al.*, The Treatment of Acute Infectious Hepatitis, Controlled Studies of the Effect of Diet, Rest, and Physical Reconditioning on the Acute Course of the Disease and on the Incidence of Relapses and Residual Abnormalities, *J. Clin. Invest.*, *34:* 1163–1235, 1955.

scholastic standing may not be jeopardized by prolonged absence from classes. The time for return to class can only be determined by careful consideration of each patient. This includes not only evaluation of physical and laboratory findings, but of emotional and situational factors. It has been our experience that prolonged symptoms, blamed on infectious mononucleosis are often of neurotic origin and may be the first indication to the physician that emotional problems exist. Thus alerted, appropriate measures may be taken to secure definitive diagnosis and treatment.

The second fact disclosed by the study concerns the use of antibiotics. The percentage of patients with infectious mononucleosis treated with an antibiotic varied from 43 per cent to 94 per cent. There is no clear-cut evidence that antibiotics are of value in the treatment of infectious mononucleosis unless there is secondary bacterial infection as a complication. The length of hospitalization averaged 4.4 days in Hospital 2, which treated 94 per cent of cases with antibiotics, and 4.6 days in Hospital 4, where only 43 per cent of patients were given antibiotics. The difference in the numbers of patients treated with antibiotics cannot be explained by the incidence of complications for there are more recorded complications in Hospital 4 than in Hospital 2. It may be argued that the use of antibiotics in nearly all cases of infectious mononucleosis in Hospital 2 was the reason for the low incidence of complications. This would not be in agreement with the recorded findings of Weinstein, who failed to find any benefit from use of chemotherapeutic agents to prevent secondary bacterial infection in patients with measles. In fact, the incidence of secondary infection was higher in those given prophylactic antimicrobial agents. Similarly, cases of bulbar poliomyelitis who received antibiotics prophylactically had a higher incidence of secondary bacterial pneumonia and other secondary infections than did those who received no chemoprophylactic treatment.[2]

Further, since the length of hospital stay was not significantly shortened as compared to Hospital 4, where less than one-half of the patients received antibiotics, it seems evident that many patients derived no benefit from the antibiotics. The complications

[2] L. Weinstein, The Chemoprophylaxis of Infection, *Ann. Int. Med.*, *43:* 287–298, 1955.

and disadvantages resulting from the unnecessary use of antibiotics are too well known to require discussion here.

Examination of the findings for patients with virus pneumonia shows a variation in length of hospitalization of 100 per cent similar to that found for patients with infectious mononucleosis. The final evaluation of management of these patients does not indicate that patients suffered as a consequence of the shorter hospital stay. In fact, the number considered to have received very good care was higher in those hospitals where the average length of hospitalization was shorter.

In all four hospitals which participated in the study of care of virus pneumonia nearly all patients received antibiotics. This was so in spite of the fact that the value of antibiotics in this disease is at best controversial. Better-controlled studies such as that reported by Wolf and Brown indicate that the use of broad-spectrum antibiotics "did not alter the duration of pneumonitis in primary atypical nonbacterial pneumonia." [3] This point of view is supported by Bunn, who states, "With the presumed diagnosis of a viral infection treatment [antibiotic] is *not* given." He further states, "It is the considered consensus of those who study pneumonia that the general thesis should be as follows: No antimicrobial therapy for diagnosable infectious disease, in lung or elsewhere, caused by viruses is warranted.[4]

Secondary implications of this evaluation study concern the economic aspect and are pertinent to studies of Blue Cross hospitalization plans which have been especially concerned with prolonged or unnecessary hospitalization. In student health work two facets are of importance. Higher education is expensive in these times and each day lost from classes represents, at least theoretically, a sizable investment, whether made by the student and his parents, by endowment funds, by public funds, or other sources. Should the absence from classes result in inability to complete the semester, an even greater loss occurs. Of lesser but not of insignificant importance is the cost of hospitalization and medication.

[3] R. L. Wolf and L. T. Brown, Primary Atypical Non-bacterial Pneumonia, an Evaluation of the Efficacy of Antibiotic Therapy, One Hundred Eighteen Cases, *A.M.A. Arch. Int. Med., 97:* 593–598, 1956.

[4] P. Bunn, Fundamental Considerations in the Chemotherapy of Acute Pneumonias, *Am. J. Surg., 90:* 601–610, 1955.

Mounting costs for medical care are a cause for increasing concern to administrators and in fact to almost everyone and constitute one argument for some type of medical care plan. However medical care is provided, its cost is eventually shared by all and should be a concern to all.

In the final analysis decisions concerning the care of patients should be made after full consideration of all factors relating to each individual patient. The one factor in caring for students which is of somewhat greater importance than for most patients from other groups is the length of time lost because of illness. It, therefore, should be the policy of everyone who is responsible for medical care of ill students to judge carefully so that they may not be kept unnecessarily from classes.

## ANNOUNCEMENT OF RESEARCH GRANTS

THE Committee on Research of the American College Health Association is pleased to inform members that the Continental Casualty Company has established grants in support of research in student medicine. The purpose of these grants is to encourage investigations which will promote the physical and mental health of college students and benefit student medicine practices. Grants will be limited to research projects related to these objectives.

Two grants of $500 each are made annually. One grant will be awarded to support research in a college of less than 2,000 enrollment, and a second in a college with an enrollment of more than 2,000. The grants may be used for either clinical or experimental research, serving as the sole support for exploratory or small-scale studies or as supplementary support for larger projects.

Grant recipients will be selected annually by the Committee on Research of the A.C.H.A. Member colleges are invited to submit research proposals (six copies) at any time. The copies should indicate the size of the college but not its name. Recipients will be selected from proposals received before February 1, 1959, and announced at the annual meeting. Selection will be based on the merits of the research design and the apparent value of the project to the field of student medicine.

Proposals can be mailed to Douglass S. Thompson, M.D.,

chairman, Section on Clinical Observations and Research, New York University, New York 3, New York.

## CASE REPORTS WANTED

IN previous issues of *Student Medicine* we have published a department, "Case Reports of the Cornell University Infirmary and Clinic." Now that *Student Medicine* is the official publication of the American College Health Association, we would like to make that department more representative of college and university practices throughout the United States. We therefore request our readers to submit reports of interesting cases that are especially pertinent to the field of student medicine.

We cannot promise that all case reports will be published, but we will carefully consider each one that is submitted and select those which we believe to have instructive value and widespread interest.

Case report manuscripts should be sent to: The Editor, *Student Medicine*, Gannett Clinic, Ithaca, New York.

# Low-Resistance Syndromes*

CUTTING B. FAVOUR, M.D., STANFORD UNIVERSITY†

THE phenomenon of hypogammaglobulinemia and recurrent pyogenic infections [1] has attracted attention to a variety of clinical states of diverse causes which are characterized by increased susceptibility to infections.[2, 3] These studies on gamma globulins have re-emphasized the importance of other host defensive mechanisms [4] against infections and toxic agents. This report is concerned with disorders in the cellular systems which protect the animal's body against infections and antigenic invasions of tissues. For convenience, these disorders have been called "low-resistance syndromes." The causes of low-resistance syndromes are:

1. Neutropenia.
2. Metabolic dysfunction of phagocytic cells (vitamin-C deficiency, diabetes).
3. Diminished plasma cell activity (low-antibody globulin).
4. Deficient nonhumoral immunity.
5. Cortisone therapy.

## THE RETICULOENDOTHELIAL SYSTEM

There are four major kinds of cells which make up the so-called reticuloendothelial defense system. These cell types are possessed by various vertebrates, including mammals, reptiles, amphibians, and fish. Invertebrates lack two of these cell types, namely, nonphagocytic lymphoid cells and the plasma cells (Table 1). In-

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*Table 1.* Comparative immunology—Reticuloendothelial system.

| | PMN | Mono-cytes | Lympho-cytes | Plasma cell | Acquired immunity | Natural immunity |
|---|---|---|---|---|---|---|
| Invertebrates | + | + | 0 | 0 | Partly specific | Variable |
| Vertebrates: Embryo | Early | Early | Late | Late | Late | Weak |
| Adults | + | + | + | + | Specific | Present |

vertebrates also lack certain aspects of acquired immunity which will be discussed later on in this review. A consideration of the function of the five basic cell types in the control of microbiological invasion of tissue will place the low-resistance syndromes in proper perspective.

## GRANULOCYTES

The polymorphonuclear leucocyte (PMN) is the primary cell in the body's defense against extracellular parasitic and particulate tissue invasion.[5] Its promptness on the scene of a local infection constitutes our first line of defense against microbiological infection. The major burden of removal and destruction of saprophitic tissue invaders falls upon the PMN. When organisms get into the blood stream they are phagocytosed literally within seconds [6] and thereafter rapidly removed from the blood stream.[7] Even pathogens like the tubercle bacilli are initially taken up from body fluids by PMN.[8] In the case of some bacteria which are virulent by virtue of a slippery capsule, PMN are able to destroy such organisms if once they can push them in a corner. Dr. Wood's [9] dramatic time-lapse movies of PMN engulfing and destroying pneumococci in the absence of antibodies are a clear documentation of this leucocyte function. Once phagocytosed, pneumococci are destroyed. This cell destruction of microorganisms depends on many factors. Among these are their production of organic acids,[10, 11] lysozyme,[12, 13, 14] and phagocytin.[15, 16] In view of the importance of PMN in host protection it is not surprising that granulocytopenias of many causes may be followed by skin, res-

piratory, or bowel infections. A list of the common causes of neutropenia is given below:

| | |
|---|---|
| Toxic | Amidopyrine, Benzol, etc. |
| Infectious | Infectious mononucleosis |
| Blood dyscrasia | Leukemia |
| Radiation | Ionization |
| Antimetabolites | HN components, etc. |
| Idiopathic neutropenia | ?Anticell antibodies |

When the absolute granulocyte count drops below 1,000, intercurrent pyogenic infections, either with pathogenic organisms or saprophitic organisms, may occur. Absolute PMN counts below 500 are much more likely to lead to infections, although certain individuals may go for long periods with 200 PMN/mm$^3$ without pyogenic complications.

In some examples of idiopathic neutropenia, it is likely that increased susceptibility to infection is due to metabolic abnormalities in the neutrophils themselves and to other factors. Patients with myeloid leukemia in which the peripheral white blood cells show a diminished phagocytic capacity [17] are prone to secondary infections. In the nonleukemic patient, numerous derangements of leucocyte metabolism are accompanied by altered cell function and a lowered resistance to infection. Among these are vitamin-B deficiency,[18] vitamin-C deficiency,[18, 19] and temperature below 15° C. or above 40° C.[20, 21, 22]

Secondary infections complicating neutropenia have been described in cases of drug-induced agranulocytosis,[23] idiopathic neutropenia,[24, 25] and in falls in white count associated with radiation exposure.[26] Antibiotic therapy may be helpful.[26, 27] Acute infections may respond well to antibiotics despite low white blood counts.

## MONOCYTES

Like granulocytes, monocytes, under the various names which have been applied to them,[28, 29, 30] are phagocytic. They, too, are a primitive cell type,[31] found in invertebrates as well as vertebrates. They are an important part of granuloma formation in various lower animals as well as in vertebrates. They are slower

to appear at the sites of inflammation than are PMN, but are the most powerful phagocytes in the body.[29] They characterize indolent processes and are able to take up and hold agents which may not have been controlled by granulocytes. Efforts to show that these cells acquire immunity independent of host humoral immunity [32] have not been duplicated.[33, 34] There are good reasons for believing that the capacity of mononuclear phagocytes to destroy tubercle bacilli once they are ingested is the basis for immunity in tuberculosis.[35, 36] Morphological studies on their part in combatting intracellular parasites such as brucella [37] and typhoid bacilli [38] have suggested that virulent microorganisms are protected against the destructive effects of humoral agents so long as they remain within cells of this series. Microorganisms which have first been exposed to specific antibodies may be destroyed by monocytes just as they can be by granulocytes. Like granulocytes, monocytes possess a nonspecific capacity to destroy microorganisms. This capacity appears to depend upon changes in intracellular pH,[39] on organic acid production,[10, 11] and upon unknown mechanisms under genetic control.[40]

The manner in which deficits in the function of phagocytic mononuclears contribute to low resistance to a given infectious agent has had limited study. The effect of hormones on mononuclear cell activity will be described later.

## TISSUE CELLS

Although a major part of host protection against tissue invaders is a function of the reticuloendothelial system, various body cell types,[41, 42] including PMN and phagocytic mononuclear cells, may offer either a favorable or an adverse environment for the survival of one or another infectious agent. Years ago, Goodpasture [43] made studies of this process in embryo hen's eggs during the stage before the immune and phagocytic system had developed. He found that coliform organs tended to grow first in the gastrointestinal tract, and organisms which normally inhabit the respiratory epithelium grew first in the upper respiratory tract. Eventually, these infections overwhelmed the embryo. Until they did, selectivity of infectious sites was striking. Apparently, tissues

vary greatly in inherent inhibitory or growth-stimulating capacity, even in the absence of acquired immunity.

More recently, one of these inhibitory cellular systems has been studied intensively. Hirsch [44] has found that the well-known resistance of the guinea-pig kidney to experimental infection with tubercle bacilli, in contrast to the general susceptibility of the animal to tuberculosis, is correlated with this organ's content of spermine which, in the presence of spermine oxidase, will inhibit the growth of the tubercle bacilli.

## PLASMA CELLS

Recent reports [45, 46, 47, 48, 49] have marshaled evidence that the plasma cells make the most of the circulating antibody–gamma globulin of the peripheral blood. These humoral protective proteins [50] agglutinate, lyse, and opsonize microorganisms and neutralize their toxins. Antibodies alone, without the help of phagocytic cells, usually are antitoxic rather than directly antibiotic. They are the primary mediators of acquired immunity to extracellular infections.

Both plasma cells and gamma globulins have been found throughout vertebrate species. In contrast, both invertebrates and vertebrate embryos, each of which does not make antibody globulins, do not possess a plasma cell system.[31] In comparative immunology, as in comparative anatomy, ontogeny seems to recapitulate phylogeny. According to this concept, the human with hypogammaglobulinemia has an active defense system against infection similar to that of either the caterpillar [51] or the infant at three to six months of age.[52] However explained, the primary hypogammaglobulinemias of man are a unique experiment of nature [53] in which an adult vertebrate has a poverty of plasma cells and gamma globulins. The importance of these cells is emphasized by the fact that recurrent pyogenic infections in hypogammaglobulinemic patients can be prevented by injection of 0.1 Gm. of normal human gamma globulin per Kg. body weight at intervals of two to four weeks.[1] This protection is equivalent to that acquired passively from the mother by the newborn infant or to that acquired naturally by the normal adult. We know that

infant gamma globulins come from the mother, for a child born of a hypogammaglobulinemic woman has no gamma globulins.[48] Under these conditions, normal gamma globulins, isoagglutinins, and responses to immunization appear after four months,[48, 52] which is the time when immunological maturity in man begins.[48]

## LYMPHOCYTES

Accumulated evidence that the lymphocyte is the reticuloendothelial cell which mediates delayed-type bacterial allergy has been reviewed recently.[54] Lymphocytes have other properties. The Harrises [55, 56] have shown by elegant *in vitro* techniques that the lymphocytes are weak antibody producers. It may be that some portion of the plasma proteins has its origin in active lymphoid tissue, which makes up so much of the lymph nodes, spleen, and round cell infiltration (a part of so many infectious processes).

Indirect evidence suggests that a part of immunity to virus infections [48] and to various types of intracellular infections which survive in mononuclear cells,[35] in walled off areas, and in other body structure is mediated by the lymphoid cell system.[57] This concept is supported by further studies on humans with hypogammaglobulinemia.[58] A large proportion of these patients have normal lymphocytes and develop delayed-type allergy and acquired immunity to virus infections. Some hypogammaglobulinemic individuals have more extensive abnormalities of their R.E. system.[48] These include gross disorders of lymph node architecture, leucopenias, and lack of both delayed-type allergy and acquired immunity to mumps [1] or vaccinia virus [59] infections. More study of this interesting condition is needed to correlate the various deficits which these patients have with function of their cellular defense system. So far, the gamma globulin–plasma cell correlation is the most secure observation made on the sixty cases [3] reported to date. Since most of them have been kept free of infections with periodic injections of gamma globulin or with the recurrent use of antimicrobial agents, it is assumed that their major deficit is in plasma cells and in their capacity to make gamma globulins.

Deficits of lymphocytes are seen in certain lymphomas. These patients may be both anergic and variably vulnerable to secondary

infections. Herpes zoster is a common late complication of this disease. It is not yet known whether a specific deficit in normal lymphocytes is associated with a tendency to recurrent infections.

## TYPES OF HYPOGAMMAGLOBULINEMIA

A classification of various types of low antibody, low globulin syndromes follows:

1. Physiologic—in infancy.
2. Primary.
   Congenital—sex-linked in males.
   Acquired—adults, either sex.
3. Secondary.
   Congenital panhypoproteinemia.
   Transient dysproteinemia.
   Hepatic disease.
   Nephrosis.
   Malnutrition.
   Abnormal plasma cells.

The physiological [52] and primary [48] type of low gamma globulin syndromes have been commented on above. The dysgammaglobulinemias [3, 60, 2] and the abnormal gammaglobulinemias are included, since persons with these disorders have low-*antibody* globulin levels, even though they may have abnormally high levels of *gamma-type* globulins in their serum. Multiple myeloma is an example of a condition in which the effective gamma globulin may be low, even when there is an excess of plasma cells and myeloma protein.

It is interesting that the host's capacity to make antibody globulin and remain free of infection may be preserved despite a severe protein depletion. Rarely does starvation,[61] in the absence of marked protein loss, affect antibody production. Even in nephrosis, where proteinuria approaches the degree of "plasmapheresis" used by Cannon [62] to inhibit antibody formation, host susceptibility to infection is seen only in extreme cases. Serum protein levels following spontaneous remission from the nephrotic state rapidly return to normal. Serum proteins in chronic nephritis without massive proteinuria usually are in the normal range, even in the

presence of moderate azotemia. On the other hand, terminal nephritis may show deficits in antibody production [63] and an increased incidence of secondary infections.

## CORTISONE AND SUSCEPTIBILITY TO INFECTIONS

The body machinery for antibody production is as resistant to wide variations in hormonal output as it is to moderate variations in protein metabolism. Of the various hormones which have been studied in this connection, the adrenal hormones have received particular attention. Physiological levels of cortisone production caused by stress states do not alter antibody production.[64] A poisonous dose of cortisone, however, will suppress both phagocytosis [65] and cell migration [66] and will block antibody production if started coincident with exposure to antigenic stimuli.[67] On the whole, the infectious complications of cortisone treatment are uncommon and have been overemphasized. Saprophitic infections which do occur, appear to be complex in origin. They depend on skin and mucous membrane alterations as well as on a direct effect of cortisone on the blood vessels and cell walls of the defensive system. Monilia infections and skin infections are well-known complications of steroid treatment. Cortisone treatment may induce infections due to more virulent organisms as well. For example, experimental models have been devised to show that mononuclear cells of the cortisone-treated animal fail to destroy tubercle bacilli.[68]

The overemphasis on the infectious complications of cortisone treatment has delayed its legitimate use in combination with antimicrobial agents in moderate physiological doses in certain infectious states. Cortisone has been used with benefit in the toxemia of typhoid fever,[69, 70] the shock of sepsis,[71] particularly due to gram-negative organisms, and in certain types of tuberculosis.[72] There is no doubt that large amounts of cortisone used over long periods of time are hazardous for microbiological [73, 74] as well as for other reasons.[75]

In passing, it is interesting to note that a lack of adrenal activity, such as in Addison's disease, has been thought to increase the

severity of infections. This is a difficult dictum to document. At least, active tuberculosis in the presence of Addison's disease has a favorable prognosis when treated with the usual antituberculosis regimens with or without cortisone.[76]

## SUMMARY

The term "low-resistance syndromes" has been used in this study to include disorders of the many protective systems of the body which are accompanied by secondary infections. Increased susceptibility to infections may be due to deficiencies in the number and function of phagocytic leucocytes, in the metabolic functions of cells, in the capacity of plasma cells to make antibody globulin, and in the number and function of lymphocytes. Grouping these various infectious states together is itself instructive. Comparing one with another emphasizes their importance and their interrelationships. These systems must be understood by the physician if he is to treat infectious diseases with wisdom as well as with antibiotics.

These examples of low-resistance syndromes focus attention on the fact that recovery from the simplest respiratory infection calls into play many forces, some natural, some general, some specific. Confining the patient to bed and administering drugs are the smallest part of the healing process. All too commonly, overemphasis on the role played by powerful medicines can lead to their uncritical or even unfortunate use in infectious diseases. He is a noble physician who remains humble in the knowledge that his ministrations do no more than turn the tide which restores his patient to health.

### REFERENCES

1. O. C. Bruton, Agammaglobulinemia, *Pediatrics, 9:* 722, 1952.
2. C. B. Favour, Agammaglobulinemia, *Stanford M. Bull., 14:* 172, 1956.
3. C. A. Domz and D. R. Dickson, The Agammaglobulinemias; Relations and Implications, *Am. J. Med., 23:* 917, 1957.
4. W. J. Nungester, Mechanisms of Man's Resistance to Infectious Diseases, *Bact. Rev., 15:* 105, 1951.
5. E. Metchnikoff, Ueber eine Sprosspilzkrankheit der Daphnien, *Virch. Arch., 96:* 177, 1884.
6. M. H. Knisely, E. H. Bloch, and L. Warner, Selective Phagocytosis: I, Microscopic Observations concerning the Regulation of the Blood Flow through the

Liver and Other Organs and the Mechanism and Rate of Phagocytic Removal of Particles from the Blood, Det Kongelige Danske Videnskabernes Selskab, Copenhagen, *Biol. Skrifter, 4:* No. 7, 1948.

7. S. P. Martin, G. P. Kerby, and B. C. Holland, A Method for Measuring Removal of Bacteria from the Blood by the Various Organs of the Intact Animal, *Proc. Soc. Exper. Biol. and Med., 72:* 63, 1949.
8. H. Bloch, Studies on the Virulence of Tubercle Bacilli; the Relationship of the Physiological State of the Organisms to their Virulence, *J. Exper. Med., 92:* 507, 1950.
9. W. B. Wood, Jr., M. R. Smith, W. D. Perry, and J. W. Perry, Studies on Cellular Immunology of Acute Bacteriemia: I, Intravascular Leucocytic Reaction and Surface Phagocytosis, *J. Exper. Med., 94:* 521, 1951.
10. G. R. McKinney, S. P. Martin, R. W. Rundles, and R. Green, Respiratory and Glycolytic Activities of Human Leukocytes *in Vitro, J. Appl. Physiol., 5:* 335, 1953.
11. H. Harris and W. R. Barclay, A Method for Measuring the Respiration of Animal Cells *in Vitro,* with Some Observations on the Macrophages of the Rabbit, *Brit. J. Exper. Path., 36:* 592, 1955.
12. A. Fleming, On a Remarkable Bacteriolytic Element Found in Tissues and Secretions, *Proc. Royal Soc., 93:* 306, 1922.
13. R. B. Hiatt, C. Flood, A. Karush, and C. Engle, The Role of the Granulocyte as the Source of Lysozyme in Ulcerative Colitis, *J. Clin. Invest., 31:* 721, 1952.
14. Q. Myrvik and R. S. Weiser, Studies on Antibacterial Factors in Mammalian Tissues and Fluids, *J. Immunol., 74:* 9, 1955.
15. J. G. Hirsch, Phagocytin: A Bactericidal Substance from Polymorphonuclear Leucocytes, *J. Exper. Med., 103:* 589, 1956.
16. J. G. Hirsch, Studies on the Bactericidal Action of Phagocytin, *J. Exper. Med., 103:* 613, 1956.
17. A. I. Braude, J. Feltes, and M. Brooks, Difference between the Activity of Mature Granulocytes in Leukemic and Normal Blood, *Clin. Res. Proc., 1:* 68, 1953.
18. C. A. Mills, Bone Marrow Nutrition in Relation to the Phagocytic Activity of Blood Granulocytes, *Blood, 4:* 150, 1949.
19. W. J. Nungester and A. M. Ames, The Relationship between Ascorbic Acid and Phagocytic Activity, *J. Infec. Dis., 83:* 50, 1948.
20. C. Zarafonetis, D. R. Harmon, and P. F. Clark, The Influence of Temperature upon Opsonization and Phagocytosis, *J. Bact., 53:* 343, 1947.
21. L. Duchon, Une Preuve du rôle cellulaire dans l'étude du conflit cellules-microorganismes; indice d'activité cellulaire, *Ann. Inst. Pasteur, 82:* 254, 1952.
22. C. A. Mills and E. Cottingham, Phagocytic Activity as Affected by Protein Intake in Heat and Cold, *J. Immunol., 47:* 503, 1943.
23. F. J. Heck, Depressive Influence on Leucocytic Numbers, *Ann. N.Y. Acad. Sci., 59:* 896, 1955.
24. J. J. Butler, Chronic Idiopathic Immunoneutropenia, *Am. J. Med., 24:* 145, 1958.
25. J. Martensson and I. Vikbladh, Idiopathic Immunoneutropenia; Report of a Case with a Leukocyte Agglutinating Factor in the Serum, *Blood, 9:* 632, 1954.
26. E. P. Cronkite and G. Brecher, The Protective Effect of Granulocytes in Radiation Injury, *Ann. N.Y. Acad. Sci., 59:* 815, 1955.
27. C. P. Miller, C. W. Hammond, M. Tompkins, and G. Shorter, The Treatment of Post-irradiation Infection with Antibiotics; Experimental Study on Mice, *J. Lab. & Clin. Med., 39:* 462, 1952.
28. F. R. Sabin, Cellular Reactions to a Dye-protein with a Concept of the Mechanism of Antibody Formation, *J. Exper. Med., 70:* 67, 1939.
29. E. H. Tompkins, Reaction of the Reticuloendothelial Cells to Subcutaneous Injections of Cholesterol; Experimental Animals: Mice, *Arch. Path., 42:* 299, 1946.
30. C. S. Wright and M. C. Dodd, Phagocytosis, *Ann. N.Y. Acad. Sci., 59:* 945, 1955.

31. C. B. Favour, Comparative Immunology and the Phylogeny of Homotransplantation, *Ann. N.Y. Acad. Sci., 73:* 590, 1958.
32. E. Suter, The Multiplication of Tubercle Bacilli within Normal Phagocytes in Tissue Culture, *J. Exper. Med., 96:* 137, 1952.
33. G. B. Mackaness, N. Smith, and A. Q. Wells, The Growth of Intracellular Tubercle Bacilli in Relation to Their Virulence, *Am. Rev. Tuberc., 69:* 479, 1954.
34. S. Raffel, "Mechanism Involved in Acquired Immunity to Tuberculosis," in *Experimental Tuberculosis,* Ciba Foundation Symposium (Boston, Mass.: Little Brown, 1955), p. 261.
35. M. B. Lurie, Mechanisms of Immunity in Tuberculosis: The Fate of Tubercle Bacilli Ingested by Mononuclear Phagocytes Derived from Normal and Immunized Animals, *J. Exper. Med., 75:* 247, 1942.
36. M. B. Lurie, Native and Acquired Resistance to Tuberculosis, *Am. J. Med., 9:* 591, 1950.
37. E. H. Tompkins and R. S. Cunningham, "Application of the Supravital Method of the Study of Blood in Pathological Conditions," in *Handbook of Hematology,* H. M. Downey, ed. (New York: Hoeber, 1938), p. 585.
38. E. W. Goodpasture, Concerning the Pathogenesis of Typhoid Fever, *Am. J. Path., 13:* 175, 1937.
39. P. Rous, The Relative Reaction Within Living Mammalian Tissues, *J. Exper. Med., 41:* 470, 1925.
40. M. B. Lurie, P. Zappasodi, and C. Tickner, On the Nature of Genetic Resistance to Tuberculosis in the Light of the Host Parasite Relationships in Natively Resistant and Susceptible Rabbits, *Am. Rev. Tuberc., 72:* 297, 1955.
41. R. J. Dubos and G. M. MacLeod, The Effect of a Tissue Enzyme upon Pneumococci, *J. Exper. Med., 67:* 791, 1938.
42. R. J. Dubos, Tuberculostatic Agent Present in Animal Tissue, *Am. Rev. Tuberc., 63:* 119, 1951.
43. E. W. Goodpasture, Use of Chick Embryo in Investigation of Certain Pathogenic Problems, *South. M. J., 26:* 418, 1933.
44. J. G. Hirsch and R. J. Dubos, Effect of Spermine on Tubercle Bacilli, *J. Exper. Med., 95:* 191, 1952.
45. W. E. Ehrich, "Adaptation Phase in Inflammation," in *Mechanism of Inflammation,* G. Jasmin and A. Roberts, eds. (Montreal: Acta, 1953), p. 25.
46. T. N. Harris and S. Harris, The Genesis of Antibodies, *Am. J. Med., 20:* 114, 1956.
47. R. A. Good, Studies on Agammaglobulinemia: II, Failure of Plasma Cell Formation in the Bone Marrow and Lymph Nodes of Patients with Agammaglobulinemia, *J. Lab. and Clin. Med., 46:* 167, 1955.
48. R. A. Good, R. L. Varco, J. B. Aust, and S. L. Zak, Transplantation Studies in Patients with Agammaglobulinemia, *Ann. N.Y. Acad. Sci., 64:* 882, 1957.
49. C. M. Martin, R. S. Gordon, and N. B. McCullough, Acquired Hypogammaglobulinemia in an Adult: Report of a Case with Clinical and Experimental Studies, *New England J. Med., 254:* 449, 1956.
50. J. F. Enders, Chemical, Clinical and Immunobiological Studies on the Products of Human Plasma Fractionation: X, The Concentration of Certain Antibodies in Globulin Fractions Derived from Human Blood Plasma, *J. Clin. Invest., 23:* 510, 1944.
51. J. P. Sanford, C. B. Favour, and M. S. Tribeman, Absence of Serum Gamma Globulins in an Adult, *New England J. Med., 250:* 1027, 1954.
52. T. O. Orlandini, A. Sass-Kortsak, and J. H. Ebbs, Serum Gamma Globulin Levels in Infancy, *A.M.A. Am. J. Dis. Child., 84:* 632, 1952.
53. R. A. Good, Agammaglobulinemia, a Provocative Experiment of Nature, *Bull. Minn. Hosp., 26:* 1, 1954.

54. C. B. Favour, Cell Injury in Allergic Inflammation, *Internat. Arch. Allergy, 10:* 193, 1957.
55. S. Harris, T. N. Harris, C. A. Ogburn, and M. B. Farber, Studies on Transfer of Lymph Node Cells: VII, Transfer of Cells Incubated *in Vitro* with Filtrates of Trypsin-Treated Suspensions of *Shigella Paradysenteriae, J. Exper. Med., 104:* 645, 1956.
56. T. N. Harris, S. Harris, and M. B. Farber, Studies on the Transfer of Lymph Node Cells: VIII, The Transfer of Cells from Blood and Peritoneal Exudates Incubated *in Vitro* with Antigenic Material Derived from *Shigella Paradysenteriae, J. Exper. Med., 104:* 663, 1956.
57. J. H. Berrian and L. Brent, Cell-bound Antibodies in Transplantation Immunity, *Ann. N.Y. Acad. Sci., 73:* 654, 1958.
58. H. M. Porter, The Demonstration of Delayed-Type Reactivity in Congenital Agammaglobulinemia, *Ann. N.Y. Acad. Sci., 64:* 932, 1957.
59. S. E. Keidan, K. McCarthy, and J. C. Haworth, Fatal Generalized Vaccinia with Failure of Antibody Production and Absence of Serum Gamma Globulin, *Arch. Dis. Childhood, 28:* 110, 1953.
60. C. H. Kempe and M. C. Benenson, Smallpox and Vaccinia, *Pediat. Clin. of N.A., 2:* 19, 1955.
61. E. G. Krebs, Depression of Gamma Globulin in Hypoproteinemia Due to Malnutrition, *J. Lab. and Clin. Med., 31:* 85, 1946.
62. P. R. Cannon, W. E. Chase, and R. W. Wissler, Relationship of Protein Reserves to Antibody Production: Effects of Low Protein Diet and Plasmapheresis upon Formation of Agglutinins, *J. Immunol., 47:* 133, 1943.
63. G. J. Dammin, J. E. Murray, and N. P. Couch, Prolonged Survival of Skin Homografts in Uremic Patients, *Ann. N.Y. Acad. Sci., 64:* 967, 1957.
64. E. E. Fischel, H. C. Stoerk, and M. Bjorneboe, Failure of Cortisone to Affect Rate of Disappearance of Antibody Protein, *Proc. Soc. Exp. Biol. & Med., 77:* 111, 1951.
65. S. B. Crepea, G. E. Magnin, and C. V. Seastone, Effect of ACTH and Cortisone on Phagocytosis, *Proc. Soc. Exp. Biol. & Med., 77:* 704, 1951.
66. M. M. Ketchel and C. B. Favour, The Effect of Hydrocortisone, Desoxycorticosterone, and Tetrahydrocortisone on *in Vitro* Leucocyte Migration, *Anat. Rec., 117:* 551, 1953.
67. E. E. Fischel, Relationship of Adrenal Cortical Activity to Immune Responses, *Bull. N.Y. Acad. Med., 26:* 255, 1950.
68. P. d'A. Hart and R. J. W. Rees, Enhancing Effect of Cortisone on Tuberculosis in the Mouse, *Lancet, 2:* 391, 1950.
69. J. E. Smadel, H. L. Ley, and F. H. Diercks, Treatment of Typhoid Fever: I, Combined Therapy with Cortisone and Chloramphenicol, *Ann. Int. Med., 34:* 1, 1951.
70. C. L. Wiseman, Jr., P. Y. Paterson, J. E. Smadel, F. H. Diercks, and H. L. Ley, Studies on Cortisone and Antibiotics for Prompt Therapeutic Control of Typhoid Fever and Scrub Typhus, *J. Clin. Invest., 33:* 264, 1954.
71. J. P. Jahn, L. Boling, T. R. Meagher, H. H. Peterson, G. Thomas, B. M. Fisher, A. E. Thill, W. A. Leovy, H. E. Balch, and L. W. Kinsell, The Combination of ACTH-Cortisone-Hydrocortisone with Antibiotics in the Management of Overwhelmingly Severe Infections, *J. Pediat., 44:* 640, 1954.
72. E. L. Kendig, Jr., S. H. Choy, and W. H. Johnson, Observations on the Effect of Cortisone in the Treatment of Tuberculous Meningitis, *Am. Rev. Tuberc., 73:* 99, 1956.
73. L. C. Mills, B. F. Boylston, J. A. Greene, and J. H. Moyer, Septic Arthritis as a Complication of Orally Given Steroid Therapy, *J. A.M.A., 164:* 1310, 1957.

74. L. Fred, M. H. Levin, J. B. Rivo, and T. F. Barrett, Development of Active Pulmonary Tuberculosis during ACTH and Cortisone Therapy, *J. A.M.A., 147:* 242, 1951.
75. P. H. Forsham, Present Status of ACTH and Cortisone in Therapy, *Med. Clin. of N.A., 35:* 1229, 1951.
76. J. P. Sanford and C. B. Favour, The Interrelationships between Addison's Disease and Active Tuberculosis: A Review of 125 Cases of Addison's Disease, *Ann. Int. Med., 45:* 56, 1956.

# Injuries Sustained in Sport—A National Problem

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WHENEVER young men gather regularly on green autumn fields, or winter ice, or polished wooden floors, to dispute the possession and position of various leather and rubber objects, according to certain rules, sooner or later somebody gets hurt.

This obvious fact has, until relatively recently, received little attention from those who plan and organize sports programs for boys and young men in this country. Coaching has become almost a true profession, commanding incomes that often amaze members of other professions; astronomical sums are spent on stadia and other establishments; but all too often the problems of prevention, diagnosis, and treatment of injuries sustained in sport are relegated to a back room in the gymnasium and a footnote in the annual budget. Perhaps this point of view is an aspect of the streak of fatalism which is so striking in American philosophy today, an "it can't happen to me" point of view, which kills forty thousand human beings every year on our highways.

Participation in organized sports in our schools and colleges is steadily increasing. It is being realized that young men must blow off steam, and the playing field is much to be preferred to the tavern. "Athletics for all" will soon be a universally accepted policy and one to which no one can possibly object.

But as more and more young men play instead of watch, more of them, inevitably, will get hurt, and the responsibilities of the medical profession will increase. Medicine is becoming aware of this challenge. A symposium on athletic injuries was arranged in

October 1957 in a midwestern city. An attendance of about one hundred was expected, but three hundred doctors associated in one way or another with athletes and athletics appeared. In December 1957 nearly two hundred doctors subscribed to a two-day postgraduate course on knee injuries alone. Three years ago a Committee on Injury in Sports was appointed by the American Medical Association. This committee is now well occupied with such matters as the establishment of minimum standards for helmets and other equipment, and the drafting of a statement of standards of care of athletes in schools and colleges.

Perhaps this matter can best be expressed from the point of view of the player. It would seem reasonable that, today, he is entitled to certain rights, such as:

1. *Good Coaching*. This has practically been realized. The coach who teaches unsportsmanlike tactics to win at any price is almost extinct. Almost all coaches today are competent instructors in the technical aspects of the game, ignorance of which, of course, greatly increases the incidence and severity of injuries.

2. *Good Equipment*. This, too, can easily be achieved. The manufacturers of equipment take their responsibilities seriously and are continually modifying and improving the various types of armor worn in contact sport. The problem lies in the false economy of using worn-out, outmoded, or ill-fitting gear. The outfitting of a team is no place for penny pinching.

3. *Good Medical Care*, which has three aspects:

a. A thorough preseason history and physical examination are necessary. These constitute the most important single factor in the prevention of injuries. A considerable number of the tragedies which occur every year are due to medical conditions, such as heart disease, hypertension, and diabetes, which were not recognized and usually constitute contraindications to participation in contact sport. For many years at Harvard, loss of function of one of any paired set of organs also has been regarded as a contraindication. This rule produces an annual crop of unhappy young men who seem to have played for years in high school with one testis, one kidney, or one eye, but no exceptions are allowed. Other less potentially dangerous sports are available, and no game is worth the risk of blindness, death, or castration.

Another important part of the preseason examination, particularly in high schools and preparatory schools, is the proper matching of players. Boys grow at different rates. Some at fifteen have matured and well-co-ordinated musculoskeletal systems. Others are small and soft, having barely entered adolescence; and still others are large-boned, skinny, and inco-ordinated, being in a period of rapid bone growth, with barely compensated nerves and muscles. To mix these types on a team is to court trouble. This is an area for co-operation between coach and doctor. Well-matched teams are much safer and much more fun for all concerned.

b. A doctor should be present on the playing field at every scrimmage and game. To leave to a trainer or coach such decisions as whether an injured player should continue play or be removed, and, if removed, whether he should be carried or walk off the field is to gamble with a player's future with the cards stacked against him.

c. The doctor's authority in matters medical should be absolute and unquestioned. Adherence to this principle is the measure of a good coach. Almost all coaches today are happy to leave medical decisions to the medical profession. They have enough difficult decisions and problems as it is.

It is quite true that the great majority of athletic injuries are not serious, will heal despite even bizarre treatment, and leave no souvenir of permanent disability, but the day of regarding this problem as "minor" and beneath the dignity of a proper doctor is gone. The late Elliott Carr Cutler expressed it well: "There is no minor surgery, but unfortunately there are many minor surgeons."

The same disciplined patterns of thought should apply to the analysis of a wrenching injury to the ankle as to the study of haemoptysis. The pathology of strains, sprains, and contusions is a nearly virgin field, and there is therefore some excuse for the medical school curriculum which devotes the same amount of time to nonchromaffin paraganglioma and the tissue changes following muscle, ligament, and tendon injury. It is to be hoped that inquiring young minds will soon lead us out of the gloom of empiricism and "clinical impression" into the daylight of fact in these areas. The results of such studies could be applied and tested

directly under ideal circumstances on the playing field, the only place where injuries can be closely observed from the moment of occurrence until full recovery.

Those who become interested in this kind of service are doubly rewarded, by the satisfaction of contributing to the health of the next generation (who, it is to be hoped, will run the world better than their predecessors) and by making a contribution toward solution of the keystone problem of all surgery, which has concerned surgeons since the time the author of the Smith Papyrus studied injuries incurred in the building of the Pyramids—the healing of wounds.

# Evaluation of Hospital Care in University Student Medical Services*

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RECENTLY there has been an increase in the number of universities offering comprehensive medical facilities for students. A survey in 1948 [1] showed that 9 per cent of the 170 medical services studied had facilities to treat all medical and surgical cases, while in 1953 [2] at least 29 per cent of 768 medical services studied were so equipped. Since a significant proportion of the student body depends upon and receives care from university-operated clinics and infirmaries, there is a need to evaluate the standard of treatment and care currently offered by such medical services.

Since medical care is a difficult subject to evaluate and cannot be done by the mere collection and analysis of statistical data, other techniques must be found. One such method has been formulated by the Commission on Professional and Hospital Activities in Ann Arbor, Michigan.[3-7] This body determines the overall standard of care by having a physician, or group of physicians, carefully review each case in a hospital. The care given in that case is evaluated as compared to the standard that would be expected in the careful practice of medicine. After each case has been so evaluated and recorded on a composite list, a broad picture emerges, which indicates the strengths and flaws of medical practice in that institution. The final picture of an institution may

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then be compared to other institutions to show where the major differences lie.

It may be that one university appears, from casual observation, to have lower standards than others. However, this is not necessarily true, because the needs of this university community may vary considerably and result in a different type of medical service entirely satisfactory for the prevailing community conditions. Conversely, a university that appears to have an exceptionally high standard on a comparative basis may actually be at a minimum level of service for the conditions which it encounters. Nevertheless, the information contained in this evaluation of medical care in university medical services has genuine value, because each participating university has evaluated its care according to its own standards and may now see how other comparable institutions evaluate their care for the same type of illness. This study shows that there is a significant difference in the care being given and in the standards used as criteria for proper medical management among the medical services studied.

It is hoped that this study will be of value in determining the standard of care offered in university medical services and will help to fill the need for information about an important subject that requires constant attention and improvement so that the level of care will be at the highest possible standard consistent with medical, university, and community interests.

## METHOD

The five universities participating in this study—Cornell, Kansas, Michigan, Minnesota, and Pennsylvania State—were selected because of certain similarities between them. They all offer comprehensive medical services with clinics and infirmaries staffed by physicians employed by the university, and so comparisons may be made among them without taking into account physical differences. Five of the universities provided data on patients with infectious mononucleosis and four on those with virus pneumonia. This paper is based on records of 239 patients with infectious mononucleosis and 103 with virus pneumonia. For the purpose of reporting the results of this study each medical service is identi-

fied by a code known only to the university medical service concerned. The hospitals are designated as 0, 1, 2, 4, and Y.

*Diseases Studied*

The records of patients with a final diagnosis of infectious mononucleosis or virus pneumonia were analyzed. It was felt that these diseases would allow an evaluation of the care offered which would fairly represent the general standard of care given by the institution. Accordingly, minor and very serious illnesses were purposely excluded from this study.

*Period Studied*

All patients who had these diseases and were treated within one school year had their records evaluated. One academic year was selected because, although any one year may be atypical, generally it affords a reasonable period of time in which peaks and valleys of epidemics and slack periods are leveled into a representative trend.

*Method of Recording the Information*

A specially designed form was completed from the record of each patient. This form was similar to that used by the Commission on Professional and Hospital Activities but was oriented to the type of medical practice found in student health services. It was designed to allow for the recording of all information pertinent to the study as well as for ready transposition to I.B.M. cards. The first section of the form was used to record such data as the age, sex, length of stay in hospital, and so forth. The second part was completed by a physician, or group of physicians, at each university, who gave an opinion on whether hospitalization was adequate, whether the records were complete, and whether investigations were adequate, insufficient, or excessive (equally important in view of our increasing concern with radiation). The physicians then decided whether treatment was correct; if antibiotics were given, whether these were necessary; and, if necessary, whether they were given in correct dosage. Finally the findings were summarized, showing where the inadequacies, if any, lay and what the general standard of management was. We thus tried to

approach the problem from a medical point of view, asking not merely, "Were antibiotics given?" but rather, "Should they have been and were they given properly?"

The evaluation was done by physicians of the medical services concerned, but, in order for the standards used to be as similar as possible, lists of criteria were sent to the participating universities. The criteria consisted of the basic points that were considered necessary in the investigation and care of patients with the two diseases under study. They were used as a background against which the standard of management could be measured and were not intended to be absolute but rather as guidelines to be used by the physicians making the evaluation. The final decision on the adequacy of care rested with the physician, as he determined whether or not the general criteria were applicable in any given case. Nevertheless, the general points did, as they were intended, result in a fairly uniform approach in the evaluation, so that the final result could be used in making broad comparisons of the standards of care in the participating medical services.

## RESULTS

Tables 1 through 6 are summary presentations of the data collected in this study. Data of particular interest is also shown graphically and will be discussed below.

### *Length of Hospitalization*

The average length of stay for patients with infectious mononucleosis varied from 4.44 to 8.38 days. (See Figure 1.) These figures were dependent, to some extent, on the number of patients transferred to their homes or to another institution, but it was found that this factor did not account in full for the differences noted. For example, Hospital 0 had the longest average stay, of 8.38 days; 3 per cent of the patients were transferred; and 97 per cent were considered to have had adequate hospitalization. Hospital 2 estimated 90 per cent to have had adequate hospitalization, and yet their average length of stay was only 4.44 days; however, they reported a transfer of 14 per cent of their patients. Hospital Y transferred 21 per cent of their patients—the highest percentage

of transfers—and yet they had the second longest average stay, 7.78 days; but in spite of the long stays they evaluated only 82 per cent of their patients as having had adequate hospitalization.

*Table 1.* General information on patients. (All figures given as percentages.)

| | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hospital | | | | | Hospital | | | |
| | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Year in college | | | | | | | | | |
| 1st | 20 | 22 | 14 | 3 | 50 | 43 | 26 | 31 | .. |
| 2nd | 42 | 21 | 40 | 7 | 18 | 25 | 37 | 27 | .. |
| 3rd | 18 | 27 | 22 | 3 | 14 | 12 | 16 | 19 | .. |
| 4th | 8 | 13 | 24 | 3 | 18 | 8 | 11 | 19 | .. |
| 5th | 6 | .. | .. | .. | .. | 4 | .. | .. | .. |
| 6th | 1 | .. | .. | .. | .. | .. | .. | .. | .. |
| Other | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Graduate | 5 | 16 | .. | 7 | .. | 8 | 10 | 4 | 20 |
| Not recorded | .. | .. | .. | 77 | .. | .. | .. | .. | 80 |
| Sex | | | | | | | | | |
| Male | 67 | 60 | 62 | 57 | 57 | 76 | 69 | 92 | 80 |
| Female | 33 | 40 | 38 | 43 | 43 | 24 | 31 | 8 | 20 |
| Religion | | | | | | | | | |
| Protestant | 55 | 64 | 66 | 71 | 82 | 49 | 68 | 58 | 70 |
| Roman Catholic | 8 | 10 | 26 | 12 | 11 | 8 | 16 | 31 | 10 |
| Jewish | 37 | 22 | 6 | 10 | .. | 39 | 11 | 8 | .. |
| Other | .. | 1 | .. | .. | .. | 4 | .. | .. | 10 |
| None | .. | .. | 2 | 3 | 3 | .. | .. | 3 | .. |
| Not recorded | .. | 3 | .. | 4 | 4 | .. | 5 | .. | 10 |
| Race | | | | | | | | | |
| White | 98 | 18 | 94 | 58 | 100 | 100 | .. | 100 | 90 |
| Black | .. | .. | 6 | 2 | .. | .. | .. | .. | .. |
| Yellow | 2 | 1 | .. | .. | .. | .. | .. | .. | 10 |
| Not recorded | .. | 81 | .. | 40 | .. | .. | 100 | .. | .. |
| Discharge status | | | | | | | | | |
| Discharged alive | 97 | 94 | 86 | 91 | 79 | 100 | 100 | 88 | 90 |
| Transferred home | 3 | 5 | 12 | 9 | 21 | .. | .. | 12 | 10 |
| Transferred to other institution | .. | 1 | 2 | .. | .. | .. | .. | .. | .. |
| Evaluation of length of stay | | | | | | | | | |
| Adequate | 97 | 96 | 90 | 85 | 82 | 100 | 100 | 88 | 90 |
| Insufficient | 3 | 4 | 10 | 15 | 14 | .. | .. | 12 | 10 |
| Excessive | .. | .. | .. | .. | 4 | .. | .. | .. | .. |

*Table 2.* Details of investigations done. (All figures given as percentages.)

| | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hospital | | | | | Hospital | | | |
| | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Urinalysis | | | | | | | | | |
| Routine (no microscopy) | .. | .. | 38 | 2 | 4 | .. | .. | 42 | .. |
| Routine + microscopy | 80 | 95 | 58 | 76 | 93 | 73 | 100 | 58 | 100 |
| Routine + blood | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Routine + special tests | .. | 1 | .. | 2 | 4 | .. | .. | .. | .. |
| Routine + bile | 11 | .. | 2 | 5 | 4 | 2 | .. | .. | .. |
| None | 9 | 3 | 2 | 19 | .. | 25 | .. | .. | .. |
| X-ray examinations | | | | | | | | | |
| Chest | 14 | 21 | 12 | 22 | 32 | 100 | 100 | 100 | 100 |
| Skull | 2 | .. | 2 | .. | .. | .. | .. | .. | .. |
| Other | .. | .. | 2 | 2 | .. | 2 | .. | .. | .. |
| None | 86 | 79 | 88 | 76 | 68 | .. | .. | .. | .. |
| No. of x-ray examinations | | | | | | | | | |
| 0 | 86 | 79 | 86 | 76 | 68 | .. | .. | .. | .. |
| 1 | 11 | 21 | 8 | 22 | 25 | 4 | .. | 27 | 30 |
| 2 | 3 | .. | 6 | 2 | 7 | 39 | 68 | 58 | 50 |
| 3 | .. | .. | .. | .. | .. | 45 | 16 | 15 | 20 |
| 4 | .. | .. | .. | .. | .. | 8 | 6 | .. | .. |
| 5 | .. | .. | .. | .. | .. | 2 | 5 | .. | .. |
| 6 | .. | .. | .. | .. | .. | .. | 5 | .. | .. |
| 7 | .. | .. | .. | .. | .. | 2 | .. | .. | .. |
| Hematology | | | | | | | | | |
| W.B.C. with differential | 12 | 46 | 44 | 24 | .. | 53 | 21 | 50 | .. |
| Two or more W.B.C. | 88 | 51 | 54 | 58 | 96 | 37 | 79 | 50 | 60 |
| C.B.C. | 2 | .. | 12 | 74 | 57 | 2 | .. | 4 | 70 |
| R.B.C. with or without Hb. | .. | 1 | .. | .. | .. | .. | .. | .. | .. |
| Hemaglobin alone | 3 | 14 | 18 | .. | .. | 2 | .. | 8 | .. |
| Haematocrit | 2 | 1 | .. | .. | .. | .. | .. | .. | .. |
| Sedimentation rate | .. | 1 | 18 | 9 | 46 | 2 | 5 | 12 | 20 |
| Bleeding &/or coagulation time | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| Special tests | .. | 1 | 2 | 7 | .. | .. | .. | .. | .. |
| None | .. | 2 | .. | .. | .. | 8 | .. | .. | .. |
| Serology | | | | | | | | | |
| Heterophile | 85 | 92 | 62 | 79 | 93 | .. | 16 | .. | 40 |
| Kahn &/or Wasserman | .. | 1 | .. | .. | 7 | .. | .. | .. | .. |
| Typing only (ABO, Rh) | .. | .. | .. | .. | 78 | .. | .. | .. | .. |
| Bacterial agglutination | .. | .. | .. | .. | 7 | .. | .. | .. | .. |
| Special antibodies | .. | .. | .. | .. | .. | 16 | .. | 8 | 50 |
| Other | .. | .. | .. | .. | .. | .. | .. | 4 | .. |
| None | 15 | 8 | 38 | 21 | 4 | 84 | 84 | 88 | 20 |

For patients with virus pneumonia the periods of hospitalization varied from 4.1 to 8.26 days. Although for these patients the number of transfers correlates to some extent with the length of stay,

*Table 3.* Details of investigations done and evaluation of investigations. (All figures given as percentages.)

| | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hospital | | | | | Hospital | | | |
| | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Chemistry | | | | | | | | | |
| Liver function tests | 19 | 24 | 4 | 21 | 14 | .. | .. | .. | 20 |
| Nonprotein nitrogen | .. | .. | .. | .. | 4 | .. | .. | .. | .. |
| Serum proteins | .. | .. | .. | .. | 4 | .. | .. | .. | .. |
| Blood sugar | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| Other | .. | 4 | .. | .. | .. | .. | .. | .. | .. |
| None | 81 | 72 | 96 | 76 | 86 | 100 | 100 | 100 | 80 |
| Bacteriology | | | | | | | | | |
| Direct smear only | .. | .. | 12 | 2 | .. | .. | .. | .. | 10 |
| Smear and culture | 34 | 9 | 8 | 31 | 11 | 10 | 11 | .. | 50 |
| Antibiotic sensitivity | 3 | .. | 6 | .. | 7 | 14 | .. | 4 | .. |
| Blood culture | .. | .. | .. | .. | 7 | 4 | 5 | .. | .. |
| Virus studies | .. | .. | .. | .. | 96 | .. | .. | .. | .. |
| Other | .. | .. | .. | 3 | .. | .. | .. | .. | .. |
| None | 63 | 91 | 80 | 64 | 4 | 76 | 84 | 96 | 40 |
| Electrocardiogram | | | | | | | | | |
| One E.K.G. | .. | 41 | 2 | .. | 4 | .. | 5 | .. | .. |
| Two or more E.K.G. | .. | 9 | .. | .. | 4 | .. | .. | .. | .. |
| None | 100 | 50 | 98 | 100 | 92 | 100 | 95 | 100 | 100 |
| Evaluation of laboratory studies | | | | | | | | | |
| Adequate | 92 | 88 | 82 | 78 | 82 | 82 | 100 | 96 | 90 |
| Insufficient | 8 | 12 | 18 | 22 | 11 | 18 | .. | 4 | .. |
| Excessive | .. | .. | .. | .. | 7 | .. | .. | .. | 10 |
| Evaluation of x-ray studies | | | | | | | | | |
| Adequate | 100 | 98 | 98 | 100 | 100 | 92 | 100 | 100 | 100 |
| Insufficient | .. | 2 | 2 | .. | .. | .. | .. | .. | .. |
| Excessive | .. | .. | .. | .. | .. | 8 | .. | .. | .. |
| Evaluation of special studies | | | | | | | | | |
| Adequate | 100 | 98 | 84 | 98 | 96 | 100 | 100 | 92 | 100 |
| Insufficient | .. | 2 | 14 | 2 | .. | .. | .. | 8 | .. |
| Excessive | .. | .. | .. | .. | 4 | .. | .. | .. | .. |
| Not recorded | .. | .. | 2 | .. | .. | .. | .. | .. | .. |

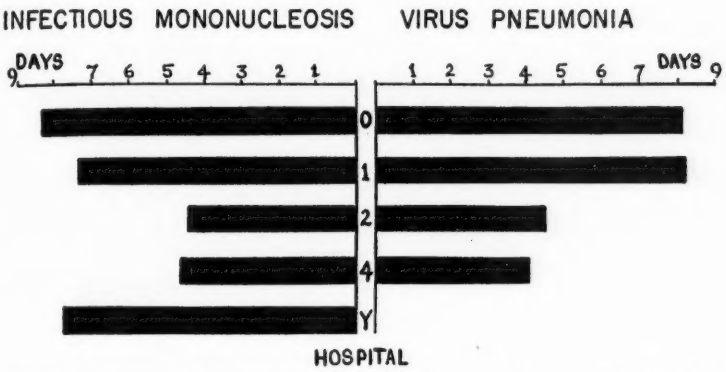


*Figure 1.* Average length of hospitalization of patients in each hospital.

this did not completely account for the differences between the universities.

It is of interest that there are significant differences in the periods of hospitalization and in both disease groups: the same hospitals (0 and 1) reported the longest stay, and Hospitals 2 and 4 the shortest ones. In spite of the differences, and taking into account the number of transfers, these shorter or longer stays were evalu-

*Table 4.* Showing incidence of complications and evaluation of chemotherapy and antibiotic treatment. (All figures given as percentages.)

| | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Complications recorded | | | | | | | | | |
| None | 98 | 91 | 96 | 84 | 93 | 100 | 95 | 100 | 90 |
| Not preventable | 2 | 9 | 4 | 14 | 7 | .. | 5 | .. | 10 |
| Probably preventable | .. | .. | .. | 2 | .. | .. | .. | .. | .. |
| Chemotherapeutics and antibiotics | | | | | | | | | |
| Properly not given | 45 | 40 | 6 | 57 | 57 | 12 | .. | 4 | .. |
| Improperly not given | .. | 2 | .. | .. | .. | .. | .. | .. | .. |
| Properly given | 52 | 52 | 92 | 17 | 43 | 84 | 100 | 96 | 90 |
| Too much given | 2 | .. | 2 | .. | .. | 4 | .. | .. | .. |
| Too little given | .. | 5 | .. | .. | .. | .. | .. | .. | .. |
| Given when inappropriate | 1 | 1 | .. | 26 | .. | .. | .. | .. | 10 |
| Patients treated with antibiotics | 55 | 58 | 94 | 43 | 43 | 88 | 100 | 96 | 100 |

ated as adequate in most of the cases. This would indicate that there is a difference in policy regarding the length of hospital stay considered necessary.

*Urinalysis*

Although it is considered necessary for all patients admitted to a hospital to have a urinalysis, and this is required by the Joint Commission on Accreditation of Hospitals, it was found that of the patients with infectious mononucleosis from 2 to 19 per cent

*Table 5.* Details of records and evaluation of history, physical, and progress notes. (All figures given as percentages.)

| | | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Hospital | | | | | Hospital | | | |
| | | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Were the following examinations recorded? | | | | | | | | | | |
| Blood pressure | Yes | 28 | 2 | .. | 62 | 25 | 20 | 5 | .. | 50 |
| | No | 72 | 98 | 100 | 38 | 75 | 80 | 95 | 100 | 50 |
| Heart | Yes | 100 | 99 | 100 | 90 | 100 | 94 | 100 | 100 | 100 |
| | No | .. | 1 | .. | 10 | .. | 6 | .. | .. | .. |
| Lungs | Yes | 100 | 99 | 100 | 95 | 100 | 100 | 100 | 100 | 100 |
| | No | .. | 1 | .. | 5 | .. | .. | .. | .. | .. |
| Throat and glands | Yes | 100 | 100 | 100 | 98 | 100 | 96 | 100 | 100 | 100 |
| | No | .. | .. | .. | 2 | .. | 4 | .. | .. | .. |
| Evaluation of history | | | | | | | | | | |
| Adequate | | 98 | 100 | 100 | 100 | 93 | 100 | 89 | 100 | 90 |
| Insufficient | | 2 | .. | .. | .. | 7 | .. | 11 | .. | 10 |
| Evaluation of physical examination | | | | | | | | | | |
| Adequate | | 88 | 99 | 98 | 84 | 96 | 82 | 100 | 100 | 70 |
| Insufficient | | 12 | 1 | 2 | 14 | 4 | 18 | .. | .. | 30 |
| Not recorded | | .. | .. | .. | 2 | .. | .. | .. | .. | .. |
| Evaluation of progress notes | | | | | | | | | | |
| Adequate | | 79 | 99 | 100 | 86 | 96 | 74 | 100 | 100 | 90 |
| Insufficient | | 21 | 1 | .. | 5 | 4 | 26 | .. | .. | 10 |
| Not recorded | | .. | .. | .. | 9 | .. | .. | .. | .. | .. |

*Table 6.* Summary of deficiencies found in care of patients and evaluation of the general management of cases. (All figures given as percentages.)

| | Infectious mononucleosis | | | | | Virus pneumonia | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Hospital | | | | | Hospital | | | |
| | 0 | 1 | 2 | 4 | Y | 0 | 1 | 2 | 4 |
| Deficiencies in care | | | | | | | | | |
| None | 68 | 81 | 82 | 31 | 53 | 47 | 84 | 96 | 40 |
| Recording | 20 | 1 | .. | 33 | 7 | 25 | 16 | .. | 60 |
| Investigation | 11 | 12 | 16 | 21 | 7 | 26 | .. | 4 | .. |
| Incomplete diagnosis | 2 | 2 | 8 | .. | .. | .. | .. | .. | .. |
| Treatment | 2 | 8 | 2 | 31 | .. | 4 | .. | .. | 10 |
| Other | .. | .. | .. | .. | 33 | .. | .. | .. | .. |
| Management of case | | | | | | | | | |
| Superior | .. | 1 | .. | .. | 18 | .. | .. | 4 | .. |
| Very good | 72 | 45 | 94 | 55 | 50 | 53 | 68 | 92 | 80 |
| Good | 26 | 41 | 4 | 36 | 25 | 37 | 32 | 4 | 10 |
| Fair | 2 | 13 | 2 | 9 | 7 | 10 | .. | .. | 10 |
| Poor | .. | .. | .. | .. | .. | .. | .. | .. | .. |

had no record of this procedure, and one hospital (Hospital 0) reported that 25 per cent of their virus pneumonia patients had none.

*X-Ray Examination*

We found a significant difference in the number of x-rays taken by the different hospitals. (See Figure 2.) The average number of

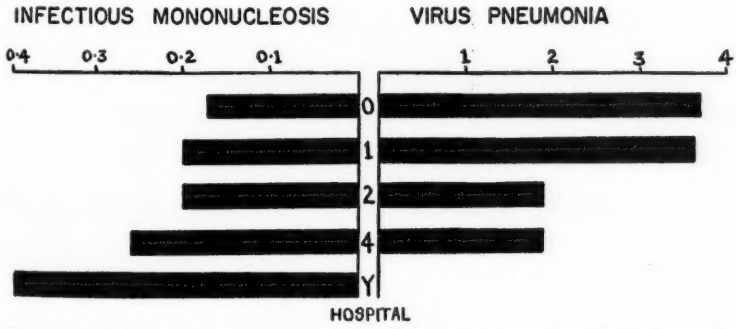


*Figure 2.* Average number of x-ray examinations per patient in each hospital.

x-ray examinations per patient in the infectious mononucleosis group was highest in Hospital Y, 0.4, and Hospital 0 had the lowest average, 0.17. For the patients with virus pneumonia Hospital 0 reported the highest average, 2.73, and Hospital 1 was very close with an average of 2.63. However, Hospital 0 considered 8 per cent of their patients to have had excessive examinations. The other hospitals considered the number of x-rays taken to be correct.

*Hematology*

In each hospital the majority of patients had two or more white blood cell counts with differential. No record of hematological investigation was found in 2 per cent of the patients with infectious mononucleosis in Hospital 1, and in 8 per cent of the patients with virus pneumonia in Hospital 0.

*Serology*

For patients with infectious mononucleosis the percentage with heterophile antibody determination recorded varied between 62 per cent and 93 per cent, a significant difference. (See Figure 3.)

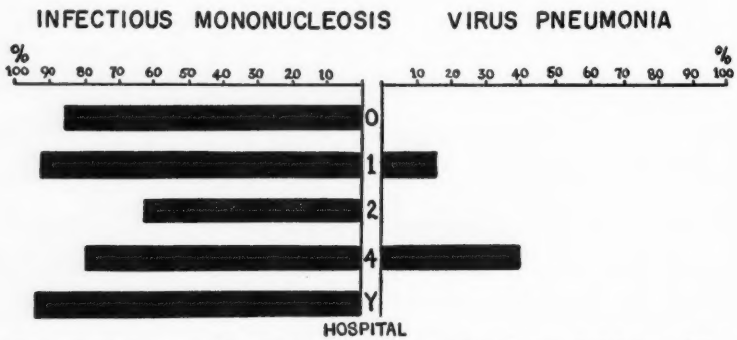


*Figure 3.* Percentage of patients in each hospital with recorded heterophiles.

In evaluating laboratory studies this investigation was not considered mandatory by some hospitals, and thus the difference indicates a difference in policy among the hospitals as far as this investigation is concerned. In the virus pneumonia group the

number with no serology recorded varied from 20 per cent to 88 per cent, dependent, to a large extent, on whether special antibody studies were done.

*Chemistry*

In those patients with infectious mononucleosis it is seen that the percentage with liver function tests varied from 4 per cent to 24 per cent. (See Figure 4.) These differences do not run parallel

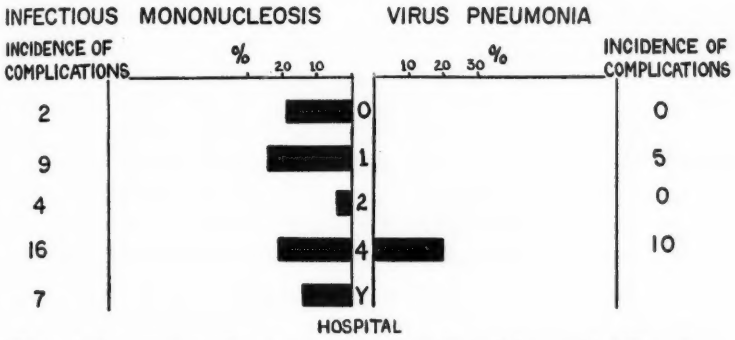


*Figure 4.* Percentage of patients in each hospital with recorded liver function tests. The side columns show the percentage of patients who had complications.

with the recorded incidence of complications. For example, Hospital 0 had 2 per cent of patients with complications but performed liver function tests on 19 per cent of their patients, while Hospital 4 with complications in 16 per cent performed these tests on 21 per cent. It seems unlikely that the incidence of hepatic involvement varied to the extent indicated by the differences in the numbers of patients having liver function tests.

*Bacteriology*

The number of patients with infectious mononucleosis with no bacteriological studies varied from 4 per cent to 91 per cent, but the lower figure is due to the special viral studies done by this hospital (Y). If we exclude these studies, we find that the number of patients with no record of bacteriological studies varied from

63 per cent to 91 per cent, and smears and cultures were taken from 9 per cent to 37 per cent of the patients. This incidence of studies does not run parallel with the recorded number of patients having complications. In the patients with virus pneumonia the number with no bacteriological studies varied from 40 per cent to 96 per cent. This difference is again significant and must be accounted for by differences in policies.

*Electrocardiograms*

It will be seen that most of the hospitals did not perform electrocardiograms on their patients (Table 3). However, Hospital 1 recorded them in 50 per cent of the patients with infectious mononucleosis.

*Antibiotic Treatment*

The number of patients with infectious mononucleosis treated with antibiotics varied from 43 per cent to 94 per cent. It was found that the hospital treating 94 per cent of their patients with antibiotics (Hospital 2) considered only 2 per cent to have been

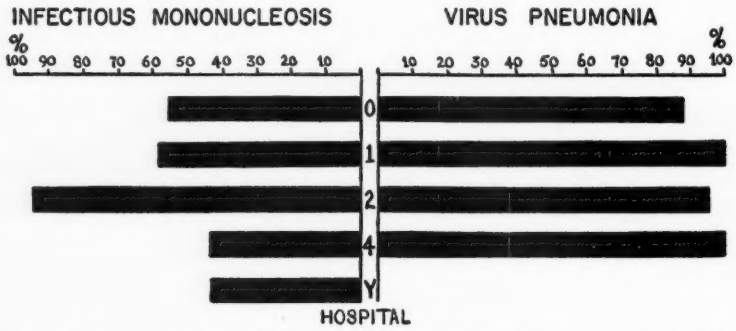


*Figure 5.* Percentage of patients in each hospital who were treated with antibiotics.

given them improperly, while Hospital 4, treating only 43 per cent with antibiotics, considered 26 per cent (more than half of those so treated) to have been given them inappropriately. This indicates that there is a difference in opinion among the hospital staffs as to the need for antibiotics in this disease.

The majority of patients with virus pneumonia were treated with antibiotics in all of the hospitals; the numbers varied from 88 per cent to 100 per cent, and most of the patients were considered to have been correctly treated.

*History, Physical Examination, and Progress Notes*

In all of the hospitals the records were considered adequate in the majority of cases. (See Table 5.) Hospitals 1, 2, and Y recorded adequate histories, physicals, and progress notes in from 89 per cent to 100 per cent of their patients, and most of these were in the 98 to 100 per cent range. Hospital 0 recorded inadequate physical examinations in 12 per cent and inadequate progress notes in 21 per cent of their infectious mononucleosis patients, and 18 per cent and 26 per cent respectively in those with virus pneumonia. Hospital 4 listed 16 per cent of their physical examinations and 14 per cent of their progress notes as inadequate for the infectious mononucleosis patients, and 30 per cent and 10 per cent respectively for those with virus pneumonia. These latter two hospitals were poor in their record-keeping and in the final listing of deficiencies (Table 6) had the fewest records with no deficiencies.

*Deficiencies Noted*

The number of records with no deficiencies noted varied from 31 per cent (Hospital 4) to 82 per cent (Hospital 2) in the infectious mononucleosis group, and from 40 per cent (Hospital 4)

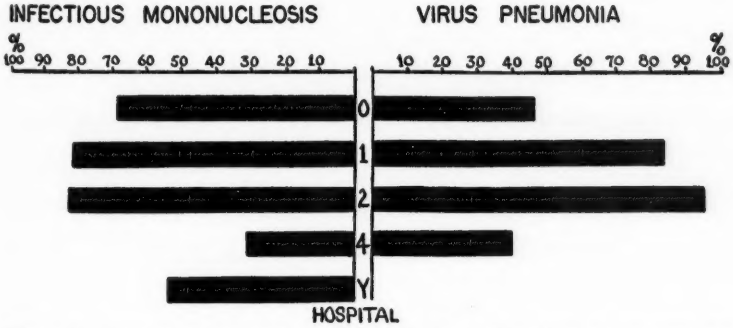


*Figure 6.* Percentage of patients in each hospital where there was no deficiency in care.

to 96 per cent (Hospital 2) in the patients with virus pneumonia. Most of the deficiencies were found in the areas of recording and investigation, though Hospital 4 reported 31 per cent of their infectious mononucleosis patients as having deficiencies in treatment.

The over-all evaluation of management did not correlate with the deficiencies noted. For example, Hospitals 1 and 2 reported deficiencies absent in 81 per cent and 82 per cent of their infectious mononucleosis patients, but Hospital 1 considered 46 per cent to have received superior or very good care, while Hospital 2 considered 94 per cent of their patients to fall in this group. This is due to the fact that a case may have been evaluated as well-managed even though a minor deficiency may have been present in one area.

Only a small percentage of patients—from none to 13 per cent—were considered to have received only fair care, and none were believed to have received poor care.

## DISCUSSION

Distinct differences in the policies of the participating university student health services have emerged in the results of this study. The question which needs to be answered is whether or not these differences indicate a significant variance in the standard of care. Since the majority of cases were evaluated as receiving good or superior care, there is obviously a need for the policies themselves to be re-examined in the light of the findings in other institutions. For example, one hospital treated 94 per cent of their infectious mononucleosis patients with antibiotics as compared to another in which only 43 per cent of the patients were so treated. Yet both institutions had similar length of hospitalization, and both felt that the treatment was generally good. This would seem to indicate that while both the policy and standard of care in any one hospital may be acceptable, there is a need to discover the reasons for the differences found when comparison is made with other hospitals.

All of the participating hospitals found certain deficiencies in their service. Thus highlighted, these deficiencies may now be remedied. Equally important is the fact that the results have

shown how significantly policies differ from institution to institution. Although it is not possible to say which policy is superior to the others, it is important to note the differences and to have each medical service decide for itself whether or not, in the light of the findings in other services, the policy it follows has resulted in the standard of care desired.

## CONCLUSION

The following facts, which emerged from this study, impressed us as significant.

1. The general standard of care in these university student medical services is good, although each service has certain areas that need concerted effort to improve them to the level of best medical standards. The evaluation showed that the percentage of cases rated as having received excellent or good care ranged from 87 to 100, while the maximum number recorded as "fair only" was 13 per cent.

2. The most common deficiencies were in the area of recording.

3. There is an interesting difference in the frequency of use of antibiotics in the participating universities. Equally interesting is the possible effect that the different usage had on other aspects of care.

4. The techniques of investigation varied considerably between the participating medical services, and it is indicated that some of the investigations did not coincide with what was considered proper procedure at other institutions.

5. Policies and standards varied to a considerable extent between the universities. Even with these differences, however, the participating services, using the criteria supplied to them as reference lines, reached a high degree of unanimity in the final evaluation of the standard of care actually given. All participants felt that the standard was good or excellent in the majority of cases reviewed. But, we are forced to believe that the over-all picture which emerged from this study indicates that the standard of medical care actually rendered cannot be, if the statistics are accurate, on as high a level as the individual members believe. Even allowing for community differences, we would expect to

find a reasonable amount of agreement on the generally accepted management of these diseases. In the absence of such agreement it is probable that the standards of treatment also vary.

6. We believe that it is possible to reach an objective measure of the standard of care, using the technique of this study, and have found it practical to design such a study so that automatic computing equipment may be used to simplify analysis of the data.

## ACKNOWLEDGMENTS

The advice and encouragement of Dr. Norman S. Moore, Director of Cornell University Infirmary, is gratefully acknowledged. I am also indebted to Dr. Vergil N. Slee of the Commission on Professional and Hospital Activities for his advice, and to the physicians of the Student Medical Services of the Universities of Kansas, Michigan, and Minnesota and Pennsylvania State University for their help and interest.

### REFERENCES

1. N. S. Moore, Salaries of Full Time Physicians in College Student Health Services, *Proceedings of the 26th Annual Meeting, Amer. College Health Assoc.* (*Bull. No. 28*, 132–134; Minneapolis, Minn.: *J. Lancet*, 1948).
2. N. S. Moore and J. Summerskill, *Health Services in American Colleges and Universities* (Ithaca, N.Y.: Cornell University Press, 1953), p. 44.
3. R. S. Myers, V. N. Slee, and G. Hoffman, The Medical Audit, *Modern Hospital, 85:* 77–83, 1955.
4. C. W. Eisele, V. N. Slee, and R. G. Hoffman, Can the Practice of Medicine Be Evaluated?, *Annals of Internal Medicine, 44:* 144–161, 1956.
5. R. S. Myers and V. N. Slee, Basic Ingredients of a Medical Audit, *Modern Hospital, 86:* 62–65, 1956.
6. R. S. Myers, The Audit Makes "Evaluation" Meaningful, *Modern Hospital, 87:* 96–108, 1956.
7. R. S. Myers, A Technique for Evaluating Professional Activities, *Hospital Progress, 38:* 42–44, 1957.

# Financing a College Health Program*

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THE problem of financing a college health service, including a supplemental insurance program, obviously varies from section to section in the United States, whether the college is located in an urban or rural area and whether it is large or small. In general, the smaller the school, the higher will be the unit cost per student and the fewer consultations from medical specialists.

As the result of several years' experience with this problem, several ideas about the care of students, that should be considered almost in the nature of axioms, have occurred to me. (1) Students are the least-expensive group in our population to care for so far as chronic illnesses are concerned. Acute surgical and mental problems along with hepatitis, mononucleosis, and viral infections form the chief elements in their care. (2) Student health needs should be met fully, with the coverage of the health fee as secondary to satisfaction of those needs. (3) Most controversial claims should be decided in the student's favor if real doubt exists. (4) Students should be covered by the insurance program wherever they may be and for the entire year. (5) Students should not be excused from an insurance program without making them aware of the risk they thereby assume. (6) Settlement of insurance claims should be easy and prompt. (7) Eye refractions, elective dental

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care, and psychiatric treatment outside mental hospitals are not insurable.

In making estimates of the total cost per year per student, many factors must be considered. In former years the cost of medical care differed considerably in various parts of the country, but this is no longer as true as it was thirty or forty years ago. Accounting methods must be considered in making up such an estimate. Some schools furnish a building and all the cost of upkeep to the health service. Others require the health service to pay for every detail of upkeep. Assuming that the health service must pay the entire cost of its building and of the service it gives, it is a safe estimate that the upper and lower limits for a complete health service should be from $40 to $70 per student per year. Under certain circumstances the cost may be higher than that if very expensive services are provided without extra charge to the student.

In view of the multiplicity and variety of insurance programs that are in force in the country at the present time, I think that the health service fee and insurance premiums should be separated. It is less confusing and less likely to lead to difficulty in the long run if the health service fee can be included in the tuition, but the amount should be clearly stated so that the student knows how much he is paying for health service. Probably insurance should be optional within limits. A student should have some kind of insurance, but if he does not take the plan provided by the college, he should be well aware of the risks he is assuming when he waives his right to insurance. If insurance is made rigidly compulsory, there are many complications which give rise to opposition to the whole health program. A workable compromise is to have each student automatically billed for the premium when he registers but allow those who apply within specified time limits to waive participation.

As a general rule, a college will not be in a position to give good medical service unless it has at least one full-time physician for each thousand students. In the small schools this ratio may have to be greater, and in the large schools it will be somewhat less and rather difficult to interpret, because the full-time physicians will be relatively small in number and the part-time consultants and specialists will be quite large in number. For example, at the

present time it is not uncommon in our larger health services to have 70 to 110 full-time and part-time physicians on the active staff.

Student health physicians have been underpaid in past years just as all teachers have been. I consider it a conservative rule that physicians should be paid at least the salaries of associate professors and professors, depending on their age, capabilities, and professional experience. An additional increment for physicians is not unreasonable, since they often have to work outside of the usual hours and have to bear great responsibility. It is a matter of self-interest for institutions to pay physicians well when physicians have demonstrated that they can handle health problems effectively and can deal with the various public relations quandaries that arise.

On the inclusion of employees and faculty members in college health plans there is a great difference of opinion. I have concluded that in the larger universities, particularly those in urban centers, it is desirable to care for employees and faculty but that such care be introduced slowly and gradually and that due attention be paid to good relations between the university and the staffs of the health services involved and the physicians in the community. Certainly from the standpoint of physicians working in health services, the work is more attractive if they can have experience along the whole spectrum of age from late adolescence to late maturity. It is not a matter of taking practice away from our colleagues in the community, but rather of organizing medical service in such a way that the members of the college or university get the best possible medical service that can be afforded in the community. Our best way of avoiding governmental control or socialized medicine is for those of us in institutions such as colleges and industrial organizations to develop full-scale medical plans which will ultimately coalesce and give the entire population the best health service the medical profession has to offer. There are many difficulties involved in an over-all scheme of this sort, but they are not as forbidding as the possibility of bureaucratic control of the practice of medicine, either from governmental organizations or those within the profession itself.

It is to be regretted that when a good medical care or health

service plan is organized in college, a few physicians and hospitals may try to take advantage of it. It is desirable that constant checks be made on charges and rates and that good relationships be built up between those who are administering the health services and those physicians and hospitals who are furnishing consultation services.

In the long run the interests of the health services coincide with those of the colleges and universities. We will not be giving our administrative colleagues a fair presentation of the facts unless we tell them clearly and honestly what a health service is going to cost, even though that cost may be far in excess of the present concepts of many administrators. Medical care is expensive, but neglect of health is even more so. If we develop a clear idea throughout the American College Health Association of what a good college health program should be and what it should cost, we will be able to give our administrative colleagues the best possible advice, and this will reflect credit on college medicine.

# Fatigue as a Symptom in Health Service Practice

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FATIGUE is a symptom and a problem common to all areas of medical practice. It is a common complaint among student patients. While fatigue is often psychoneurotic or psychosomatic in origin, it also is a frequent early sign of other disease. It is more than a little incapacitating to the individual, involving time loss and, equally important, reduced efficiency. One of the problems in health service practice is the briefness of the time allotted to see the patient. In the interview with the patient we cannot expect that he will be discriminating in his choice of words. Therefore the symptom of fatigue is often called that tired feeling, weakness, somnolence, drowsiness, asthenia, lassitude, or the miseries, and the patient may complain he is "all fagged out," "just can't get going," or "Doc, I just don't give a darn any more."

A basic problem is how to sort out the serious cases, whether organic in origin or not, and further how to do so in a short period of time. Ideally, all who complain of lassitude, weakness, fatigue, and the like should receive a complete work-up. In actuality this is neither practical nor rewarding. We are faced with the problem of how best to protect the patient and his fellows and how best to reassure ourselves. All conscientious physicians fear the possibility that they may miss a significant diagnosis. Fatigue is a common denominator of most disease states and not infrequently a prodrome of disease soon to follow. Likewise it is a common psychoneurotic manifestation. How can we be sure in a brief visit that the patient does not have diabetes, tuberculosis, leukemia, Addison's disease,

Hodgkin's disease, anemia, myxedema, or the prodrome of many infectious diseases including hepatitis and infectious mononucleosis.

Basically the problem evolves itself down to that of "What is an adequate screening program for patients with fatigue?" We believe that item one in such a program is contact with a physician. Here it is essential to explore the question of early-morning fatigue after a good night's rest. In our experience the patient who awakens in the morning more tired than when he went to bed the night before frequently has a psychiatric basis for his fatigue. Nothing in the day ahead is interesting enough to make him wish to arise. The question of week ends is important in this regard. The patient who is tired Monday through Friday and feels fine on the week end is apt to be one who is a little bored with his usual activities. He also may be one who is somewhat more prone to accidents. A positive diagnosis of a psychologic disorder as the etiology of fatigue can often be made in this manner. To do so will help to eliminate unnecessary laboratory tests, will lead to a greater satisfaction for the physician, and will allow early beginning of appropriate therapy.

In addition, at this time we must consider the question or the diagnosis of purely physical fatigue. It is important to know how much the individual works outside of his routine school activities or how much he is involved in extracurricular activities. Such small items as the laundry facilities available to a student housewife may be important. The woman who does not have access to a modern automatic washer and drier does a significant amount of work measured in foot-pounds of energy expended in simply rinsing the sheets and the family wash. Lifting a wet bed sheet out of the washing machine and through the wringer, rinsing it in the washtubs, and then carrying it up the basement stairs is a great source of energy expenditure. If the student housewife irons her husband's shirts, then she will spend the equivalent of one-half a working day each week in this occupation alone. Thus, determination of details of this type may help greatly in reaching the diagnosis of justifiable fatigue and may lead to worthwhile recommendations for the patient.

A careful and complete physical examination should be done, and inspection and observation are highly significant in the ex-

amination. Does the student appear ill? Is pallor apparent? Are there visible petechiae? Examination for lymph nodes and palpation of liver and spleen are indicated. Also, of course, temperature, pulse, respirations, and blood pressure determinations can be done. It would seem that a battery of laboratory tests selected for low expense and ease of performance might be helpful in the screening procedure. In our own opinion it would be worth while to do a hemoglobin, a white blood cell count and differential, and possibly the C-reactive protein test as an index of inflammation. A microfilm of the chest and a urinalysis are desirable. A fasting blood sugar and a two-hour post glucose blood sugar estimation are of value, particularly if there is a family history of diabetes. In general, one is safe in using 100 grams of glucose as a standard test meal. A fasting blood sugar alone, or a urine sugar alone, would be of significantly less value as a detection device for latent or early diabetes. The bromsulfalein test of liver function is particularly valuable if the liver is enlarged, since it is the most sensitive of the common liver function tests that we use. A hetrophile agglutination test is worth while if the spleen is enlarged, or the newer ox-cell hemolysin test can be used instead for the detection of infectious mononucleosis. Beyond these measures comes long-range observation to allow any incipient disease process to show its hand so that the diagnosis can be more accurately made.

In the practice of medicine we have been through popular cycles of therapeutics in the empiric treatment of fatigue as a symptom. We have used dessicated thyroid, vitamin $B_1$, vitamin $B_{12}$, and more recently tri-iodothyronine as forms of treatment. Over the same span of years we have grasped at chronic brucellosis, anicteric hepatitis, disorders of low blood sugar, and a multitude of other reassuring "diagnoses." In most patients who complain of fatigue the question of an error of metabolism sooner or later presents itself. We regularly return to disorders of the thyroid gland and to medications designed to influence a "sluggish metabolism" and thus relieve fatigue. The protein-bound iodine determination and the radio iodine uptake test have been of great aid but are not absolutely essential for diagnosis and control of therapy. It is important to recognize that nearly all of the errors that occur in the basal metabolic rate determination tend to in-

crease the reading. These include leaks in the equipment, agitation on the part of the patient, perforated ear drum, a malfitting mouthpiece, and the like. The further discussion of the diagnosis and treatment of thyroid disorders is beyond the scope of this essay except to mention that the basal metabolic rate determination and the serum cholesterol tests are still valid and very helpful.

The performance of a screening-type examination outlined above offers a reasonable modicum of reassurance to the physician that he has made an effort to rule out organic disease as the cause of fatigue. Likewise it can serve to direct his attentions more specifically toward some one organic diagnosis as the cause for this symptom. Such a program is apt to make simple reassurance much more acceptable to the patient, who feels that his problem has been thoroughly studied. In addition, the recommendations of the physician, who so often must act as a counselor to students as well, are more likely to be received with an open mind and to be adopted by the patient.

# Where Are We Going in Chest X-Rays?*

ELLIOT A. ROUFF, M.D.†

IF anyone in this audience is anticipating an erudite presentation from me and a positive answer to the question of where we are going in chest x-rays, he is going to be sadly disappointed.

For the purposes of this discussion, I have tried to set down in a somewhat orderly fashion my own evaluation regarding the utilization of x-ray screening procedures in view of the public alarm and scientific disagreement over the hazards of radiation. We who have been dealing with tuberculosis for many years have used chest x-rays as the prime tool in our diagnostic armamentarium and the fluoroscope freely as our guide to the mechanical efficacy of pneumothorax and pneumoperitoneum. In just over twenty-five years of this type of medical practice, I have been constantly aware that x-rays can be injurious to both the patient and the operator, but this awareness has been somewhat buried in the subconscious mind as a personally remote danger and a risk inherent in this type of medical therapy. Now, I don't know whether I have been right or wrong. As a resident of Pasadena living downwind from Cal-Tech, my indecisiveness has been contributed to in no small degree by the geneticists and physicists in that great institution.

There can be no argument against the thesis that all radiation exposure which serves no useful purpose should be scrupulously

* Presented as one part of a Symposium on Radiation Hazards at the Thirty-sixth Annual Meeting of the American College Health Association, Los Angeles, March 28, 1958.

† President, Los Angeles County Tuberculosis and Health Association.

avoided. As I see it, and this is far from an original concept, the problem is one of weighing the benefits from diagnostic roentgenographic procedures against the liability of harmful effects from radiation exposure. And in the possible harmful effects we are considering two separate end results; one is the possible immediate and delayed effects upon the operator and the patient and the other the possible effect upon future generations.

There are few good data applicable to humans on the effect of low doses of ionizing radiation. Most of the factual information has come from animal experimentation. Nonetheless, the unknown, as well as the known, effects of radiation exposure impose on us a definite responsibility to the public.

It didn't take the early reports from the National Academy of Sciences and those of congressional subcommittees dealing with the Atomic Energy Commission to make us decide that the day of the large x-ray survey was past. The greatest mass survey was carried out in Los Angeles County in 1950 and 1951, during the course of which some 1,800,000 adult chest x-rays were taken, uncovering 4 per cent suspicious chest findings and 44,328 tuberculosis suspects, with 2000 proven new active cases and another 1500 which could not be tracked down or completely followed. Since that time, we (by we I mean the various local health departments and tuberculosis associations) have been changing our utilization of the mobile x-ray units away from general population screening into the higher-incidence areas. This was originally carried out because of the known relatively higher yield of positive findings in skid-row areas, jail populations, hospital admissions, and the older age groups, and not really because of the possible radiation hazards.

As a result of our being able to predict with almost certainty how many suspicious cases per thousand films would be obtained in any particular group, we have been advocating more and more the use of the Mantoux tuberculin test in the school and younger age groups. During the past five years our technical knowledge relating to the mass use of this test has increased immeasurably, so that here too we are able to predict quite reliably what percentage of each particular group will be found to be tuberculin-positive and then must have a chest x-ray taken.

This is the place to make two most important facts clear: First,

to my way of thinking, the Vollmer patch test should never be used by physicians. The 1955 issue of *Diagnostic Standards* by the National Tuberculosis Association strongly advises against its use, but, in my opinion, was not emphatic enough. There is about 20 per cent error present with the patch test, and I do not believe it harms the psyche of the child any more to stick him with a 26-gage needle than to plaster a bandage on him. Second, an absolute prerequisite of any skin-testing program, in any age group, is the mandatory taking of a chest x-ray on every positive reactor. The red spot on the arm must be shown to represent past infection or past or present disease and not merely be a part of accumulating statistics.

It can be, and frequently is, asked, why all this furor when there is no tuberculosis problem? The answer to that is very simple —there is still a tremendous tuberculosis problem in this country; and the problem here is minute in comparison to that of other areas of the world. As the shrinkage in size of the globe transportationwise has resulted in longer and more frequent trips by everyone to and from the United States, we should be more alert to the direct effects of this increasing means of infection contact.

Figure 1 is taken from the 1957 report of the United States

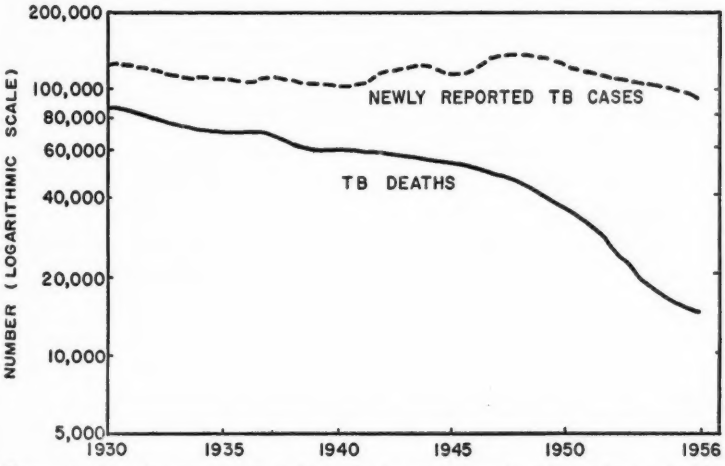


*Figure 1.* Newly reported tuberculosis cases and tuberculosis deaths United States, 1930–1956.

Public Health Service. It is readily apparent that deaths from tuberculosis have been declining rapidly but that the incidence of newly reported cases has shown far from a spectacular decline—this is the important point to make and one which has not been driven home to the public. Ninety thousand new cases is a lot of disease, and when 69,000 are classified as being active we know we are dealing with a vast pool of communicable infection. Half of the reported cases, are below the age of 43, with the 15–25-year age group corresponding to the average rate for the entire population.

In Table 1 we see a brief rundown of the results obtained from routine x-raying of some population groups. We now speak of

*Table 1.* Some typical x-ray survey results.

| | Total available | Total x-rayed | Tuberculosis suspects | Proven active tuberculosis |
|---|---|---|---|---|
| L.A. City jail 1956–1957 | 28,085 | 49,269* | 1354 | 364 |
| | | | 6.4% | 1.3% |
| L.A. County jail | 47,340 | 47,072 | 1289 | 604 |
| | | | 3.12% | 1.73% |
| St. Luke's Hospital 1956 | 11,175 | 6,175 | 230 | 6 |
| | | | 3.7% | 0.09% |
| L.A. adult schools 1955–1957 | 64,149 | 36,149 | 988 | 35 |
| | | | 2.7% | 0.09% |
| L.A. junior colleges 1955–1957 | 120,972 | 43,977 | 811 | 36 |
| | | | 1.8% | 0.08% |
| U.C.L.A. 1957 | | 11,009 | 473 | 7 |
| | | | | 0.06% |
| U.S.C. 1953–1957 | | 31,732 | 65 | 6 |
| | | | | 0.02% |

* Some individuals were x-rayed more than once.

using photofluorographic surveys only in high-incidence areas. The usually accepted example of a high-incidence area is one which will yield at least one case of active tuberculosis for every 1,500 films taken. According to this standard, the adult schools and junior colleges in the city of Los Angeles qualify, with room to spare. Other colleges may show a much smaller incidence of disease, and much smaller possibly than the surrounding community, depending upon the size of the foreign-born student body, the racial characteristics of the group, and the ratio between urban and rural residence of the students.

Something which must not be lost sight of is the fact that a single undiagnosed case of pulmonary tuberculosis in a school system, be it in a student, teacher, or maintenance worker, is a much more important source of potential infection than in one of the general adult population. Tuberculosis is only spread from person to person, and in the schools we have quite close and repeated contacts within a small circle of acquaintances. And especially is this true where the students are in residence. If the passing of a physical examination is a prerequisite for registration in a school, that examination must be as honest and complete as it possibly can be. The student's acceptance assures him that he has been found to be in good health and that every other student is likewise free of disease. It is much easier on time and personnel to march a group past an x-ray machine than it is to have an intradermal tuberculin test done, have the student return in 72 hours for the reading, and then take an x-ray of the positive reactor. This has been one of the biggest arguments in favor of routine minifilming of groups of people in school or in industry. Now that the bugaboo of radiation hazards has been raised, many schools are seriously considering abandonment of their screening units completely or, if financially able to do so, using the Mantoux test as the primary screening procedure. What can we expect to find in the college age group by this means?

Table 2 presents the result of a carefully carried out survey in Los Angeles County a little over a year ago. The younger and older age groups have been eliminated from this chart. This points out a dramatic rise in percentage of positive reactors in the 20–29-year age group, almost three times that of the group aged 19

*Table 2.* Adult tuberculin testing, Los Angeles County, 1955–1956.

| | Total no. tested | % Male positive | % Female positive | Total % positive |
|---|---|---|---|---|
| School Personnel | 1737 | 40.9 | 32.1 | 36.0 |
| Civil Service Applicants | 5245 | 48.9 | 37.6 | 44.4 |
| Industry | 1753 | 43.7 | 32.3 | 38.9 |
| Ages 10–19 | 706 | 9.7 | 8.6 | 9.1 |
| 20–29 | 2574 | 32.2 | 19.8 | 26.7 |
| 30–39 | 2768 | 46.6 | 34.4 | 41.4 |
| U.C.L.A. | | | | |
| 1941–1946 | 18469 | 43.8 | 37.7 | 39.9 |
| 1955–1958 | 3742 | 21.35 | 19.1 | 20.53 |

years and below. We also see that the school personnel have a very respectable incidence of infection.

This brings me to my final thesis. We must realize that tuberculosis is still a very serious problem in the United States. The only way by which we are going to lick this problem is to ferret out every case of active and known disease. Once we find the active case, we have the means today with which to cure, or at least control, over 90 per cent of the cases—and the earlier the disease is detected the more certain we are that we can attain a cure.

Because the question of the possible dangers of radiation damage from diagnostic, cosmic, and weapons-testing sources has been raised, we must, in all good conscience, be sure that all medical uses of x-rays are definitely indicated and use every known means of protection. We know that the individual is exposed to much more radiation from the taking of a photofluorogram than of a 14-by-17-inch chest film, possibly fifty times as much. We also know that there are a number of quite simple measures available to reduce all unnecessary scatter and direct radiation to the person being filmed by the survey unit. The spelling-out of these procedures is in the province of the radiologist, and I am certain they will be presented. The geneticists are far from agreed on how much, or how little, radiation to the gonads it takes to produce mutation of the genes and thereby a deleterious effect on future generations. In this concern they are speaking of the child-bearing

age group, usually placed up to 30 years of age (but with wide variation upward, depending upon how much the newspaper accounts of advanced parenthood are believed). Even accepting the exponents of the lowest possible permissible total radiation dosage, we have a permissive level of one photofluorogram annually from 15 to 30 years of age. And this does not take into consideration the ultimates in protection from, and better filtration of, the rays. I, therefore, do not believe we are measurably adding to any possible genetic effect from radiation by demanding routine chest x-rays of every registering class of college students. We are rendering a far greater proved benefit than potential harm to them or their progeny. Few schools can afford the routine taking of a full 14-by-17-inch chest film, which, admittedly, would be more nearly ideal.

On the other hand, medicine cannot stand still, and in the face of controversy we must be attentive to the changing concepts of science and public interest. As mentioned previously, the tuberculin test is giving us more and more information about tuberculous infection and is actually much more accurate than a single chest x-ray. Therefore, most of our tuberculosis associations have now come out with statements regarding the utilization of the Mantoux test as the primary screening procedure, provided—and this is of the utmost importance—that each and every positive reactor has a chest x-ray taken at the soonest possible moment. This, to my mind, is the ideal solution for the detection and prevention of spread of tuberculosis in our colleges.

## REFERENCES

1. National Academy of Sciences, National Research Council, *The Biological Effects of Atomic Radiation, Report to the Public from a Study by the National Academy of Sciences* (Washington, D.C., 1956).
2. National Academy of Sciences, National Research Council, *The Biological Effects of Atomic Radiation, Summary Report from a Study by the National Academy of Sciences* (Washington, D.C., 1956).
3. P. G. Hodges, Health Hazards in the Diagnostic Use of X-Ray, *J.A.M.A., 166:* 577, 1958.
4. T. A. Lincoln and E. D. Gupton, Radiation Dose to Gonads from Diagnostic X-Ray Exposure, *J.A.M.A., 166:* 233, 1958.
5. J. V. Neel, The Delayed Effects of Ionizing Radiation, *J.A.M.A., 166:* 908, 1958.
6. R. Seltser and P. E. Sartwell, Ionizing Radiation and Longevity of Physicians, *J.A.M.A., 166:* 585, 1958.

7. *Student Health Service Report, 1956–1957*, U.C.L.A.
8. *Student Health Service Report, 1953–1957*, U.S.C.
9. Summary of Tuberculosis Information, 1956–1957, Los Angeles County Tuberculosis and Health Association.
10. The Chest Roentgenogram and Chest Roentgenographic Survey Related to X-Ray Radiation and Protection from Radiation Exposure, *Am. Rev. af Tuberc.*, *77:* 203, 1958.
11. American College Health Association Committee on Tuberculosis, Tuberculosis Case Finding Program in Colleges, *J. Lancet, 75:* 146, 1955.
12. Tuberculosis Chart Series, U.S. Department of Health, Education and Welfare, 1957.

# The Nurse in the Small College

MURIEL FARR, R.N., BRYN MAWR COLLEGE

THE difference between the duties and responsibilities of the nurse in the large and in the small college is not merely one of quantity. Were this so, it could be assumed that if a college of 10,000 students employed fifteen nurses, one of 1,000 students would employ one full-time nurse and one half-time nurse and that the work of the full-time nurses in both instances would be the same. It is true that the same amount of time is needed to give bedside care or dispensary treatment to one student whether he is one out of 10,000 or one out of 1,000. In the large college, however, there is likely to be a clerk to register the patient and get his chart, whereas, in the small college this is most unlikely, and the added duty falls to the nurse.

As inconsistent as it may seem, one student out of 1,000 gives the nurse more work than one out of 10,000. The survey, *Nursing Services in College Health Departments* prepared for the Fourth National Conference on Health in Colleges, 1954, showed that the smaller the college, the greater the ratio of beds, admissions to bed, and dispensary visits, per student. In fact, between the colleges of 1,000 students and under and those of 5,000 and over, the ratio was almost two to one in all these areas. The explanation was that the smaller the college, the more personal the relationship between the student and the health service personnel. (Many nurses in large colleges have expressed their envy of this closer patient-nurse relationship enjoyed by the nurse in the small college.) It takes almost as long to interpret infirmary policies to 1,000 students, as it does to 10,000. While it is true that 1,000 students use less drugs than ten times their number, the variety used, and the time taken in ordering is about the same.

The same survey showed a surprising consistency in the ratio of nurses per one patient bed-day, regardless of the size of the college. But taking the higher admission rate, the lack of nonnursing help, and the other factors mentioned above into consideration, more nurses per student are needed in the smaller college. Even with this increase, she works a longer day. According to the survey 60 per cent of the nurses in colleges of 5,000 and over have a forty-hour week; this drops to 50 per cent in the 2,000 to 5,000 group; and to a mere 20 per cent in colleges of 2,000 and below.

In a large college the duties of the individual nurse are more clearly defined than they are in the small. There may be a doubling of responsibilities over week ends and vacation periods, but for the most part the nurse engaged to do bedside nursing does that and nothing else; the clinic nurse stays in clinic; the director or supervisor has supervising duties only. In the small health service each nurse is a "Jill-of-all-trades." In addition to routine supervisory duties the head nurse may be clerk, purchasing agent (for everything from pots and pans to penicillin), safety officer, clinic nurse, bedside nurse, teacher, or dishwasher. Any or all of these duties may be shared by the general duty nurse.

It is not, however, these duties and responsibilities which set the nurse in the small college so far apart from her counterpart in the large institution, but the necessity for making decisions, which in an orthodox hospital, or large health service setting are always the prerogative of the physician. The small college cannot have a physician present twenty-four hours a day. Even if there were enough doctors, the cost would be prohibitive. Figures show that this problem is faced by more than half the colleges in the country. Moore and Summerskill in their extensive survey: *Health Services in American Colleges and Universities*, 1953, reported that only two out of ten colleges, had full-time physicians.[1] It is reasonable to suppose that even one full-time physician cannot be present in the health service the entire day. At the 1958 American College Health Association meetings, 40 per cent of the membership was said to be in colleges having 2,000 students or less. The survey on college nursing services gave the average time for college physi-

[1] N. S. Moore and J. Summerskill, *Health Services in American Colleges and Universities* (Ithaca, N.Y.: Cornell University Press, 1953).

cians to be in the health service as four hours per day for colleges of 2,000 students or less. One college even reported one-half hour weekly as the time of the physician's visits. This means that the majority of college nurses work under "standing orders" for at least twenty out of the twenty-four hours. In the small college practically all nurses are in this category, most of them not even having the four hours of a doctor's time.

"A nurse never diagnoses." This has been, and still is, the most universal rule of nursing ethics and practice. Yet, even to interpret "standing orders" correctly she has to make what has come to be known as a "nursing diagnosis." It is easy enough to say: "Always call the college physician when abdominal pain is present." But what doctor on call twenty-four hours a day appreciates being roused from bed at 3 A.M. for a simple case of "hot-dogitis?" Does a nurse ever ask a laboratory technician, presuming there is one, to do a white blood-cell and differential count before she calls the doctor, when she suspects an acute abdomen? It has been done many times. How about a suspected fracture? Does the nurse ever call the local hospital for an x-ray before the doctor can be reached? Yes, especially if she knows the x-ray department will close in fifteen minutes, and the doctor is enroute home and probably cannot be notified for at least an hour. In fact, if the nurse has good rapport with the local surgeons and a good understanding with her college physician, the phone call has been known to go like this: "Mary Jones came in a few minutes after you left. Bad ankle injury in the gym. There was not much doubt as to what the x-ray would show, so I sent her over to the hospital. Wet plate reading was positive. Dr. P. was in the hospital. I asked him to go to see her in the x-ray department. He applied a cast, sent her back to us by taxi. I told him I'd ask you to call him as soon as you returned."

It is easy for a doctor or nurse in a large college health service to say: "In our infirmary, a nurse never admits a patient to bed or never removes an object from an eye or never removes packing, stitches, and the like." Regardless of medical and nursing ethics, the real criteria is: "What in this particular instance is best for the patient?" When asking this question the nurse must take into consideration the situation at the health service when the

patient arrives. A good nurse never performs a duty which is detrimental to the patient or absolutely against ethical practice. In an emergency, however, she must be willing to shoulder responsibility, for the good of the patient, even though she knows she may, strictly speaking, be leaving herself open to the charge of malpractice. Quite often she worriedly has to ask herself: "Which is better, to be guilty of commission or of omission?"

At the present time there is much controversy between the medical and nursing professions regarding the line to be drawn between medical treatment and nursing treatment. In the past thirty years the changes have been great, with nothing clearly stated on paper. In many hospitals nurses commonly give intravenous medication; in others only physicians ever insert the needle, although the nurse may be left in charge of the patient for the length of the procedure. Formerly, it was only a doctor who took blood-pressure readings, or who listened to fetal heart beats. No one wrote the change, it simply came as nurses were more highly trained and doctors in greater demand. But there is still a line over which the average nurse fears to pass, and the average doctor does not wish her to. It is over this line that the nurse in the small college often has to put her toe. Until such a time as there are principles actually written for such nurses, they are in a particularly vulnerable position.

Occupational health nurses and doctors have come together to write *Guiding Principles and Practices for Industrial Nurses*. While these, like "standing orders," require a nursing diagnosis for competent use, they do help both the nurse and the doctor. Might not the American College Health Association prepare such a pamphlet for the use of college health nurses?

If any physician thinks that the nurse really wants to put more than the tentative toe over the line, he should attend the nurses' section meeting of A.C.H.A. When the report "Functions, Standards, and Qualifications for College Nurses in a Supervisory Capacity" was being presented at Los Angeles in 1958 for final approval, the longest discussions centered around any clause that seemed to put treatment into the nurse's hand. We definitely need an official pamphlet "Guiding Principles and Practices for College Health Nurses."

# Health Service Responsibilities for College and University Swimming Pool Operation*

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THE assigned task of a student health service is to conserve the time of the students for their studies by *preventing* and treating acute illnesses and injuries. In order to fulfill this mission, a preventive medical program should be adjunct to treating the illness and injury. This can be done by the director, a member of his staff, or by a separate environmental service attached to or closely related to the student health service.

Environmental services at the University of California are organized for the protection of the employees, researchers, and academicians, as well as the student population. One important function of this program is the surveillance of the swimming activities on the campus and adjacent areas utilized by this total population.

A college or university campus may have one or more of the

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following swimming pools or bathing places: (1) large gymnasium pool; (2) "semipublic" pool, at faculty club, fraternities, and sororities ("semipublic" is a term applied to pools at apartments, motels, clubs); (3) therapeutic and other special purpose pool; (4) private residential pool, as at the President's house; (5) salt water beaches and lake fronts; and (6) river pools and the like.

The state-wide University of California has a legal responsibility for the operation of swimming areas of each type described. Each is under the surveillance of its Division of Sanitation in the office of the University Physician. The southern region of the University has 4 large outdoor gymnasium pools, 1 medium-size resort-type pool, 1 private residence pool, 2 ocean beach areas, 1 lake front, and 4 fraternity pools. Now in the planning stage are 1 neuropsychiatric therapeutic pool, 1 faculty club pool, and 2 additional fraternity pools. There are approximately 50,000 pools of all types in Los Angeles County alone, and they are being built at the rate of 8,000 yearly!

A type of swimming environment that is becoming more popular on the campuses located in the warmer climates, is the fraternity, and to a lesser extent, the sorority pool. Student health and environmental service personnel should be alert to this trend. At U.C.L.A. immediately after the first of the four fraternity pools appeared on the "row," a Swimming Pool Code was formulated by the Dean of Students with the assistance of the Division of Sanitation. The University's responsibility for off-campus student living groups is well established. Consequently, the maintenance of environmental conditions to satisfy this responsibility gives it more authority than the police power of the local health department. Of interest, fully a year before any other health jurisdiction, the U.C.L.A. code required fences and self-closing gates around all pools in order to protect children in the area from these "attractive nuisances."

It is not the purpose of this discussion to delve into the conflicting and somewhat obscure area of what diseases are or can be transmitted in the swimming pool. Although swimming pools can constitute a definite health hazard, there is little *real* evidence that swimming pools play an important role in the transmission of communicable diseases.

The problems of disease often considered to be of importance to swimmers are:

1. Inflammation of the upper respiratory tract and conjunctiva, leading to an opportunity for infectious agents to invade man more readily. (Therefore the incidence of respiratory disease and conjunctivitis should be greater among swimmers than nonswimmers.)
2. Injury and inflammation of ears.
3. Skin diseases.
4. Intestinal infections (from polluted swimming water).

Several studies have been reported where swimming pools were suspected of transmitting infection. One of them by Gallagher in 1948 compared illness among students at a boarding school over a seven-year period.[1] An analysis of the data presented in this study would indicate that no positive conclusion could be derived from this presentation.

Other recent studies suggest that certain viral infections may be transmitted by swimming pool water. Conjunctivitis as a clinical entity is described in some cases as a viral infection. The role of pool water as a potential vehicle of virus spread is fairly well established, however, contraction of the disease in man from such sources has not been clearly demonstrated. Also, evidence is accumulating that pools may play an important role in the spread of pharyngoconjunctival fever, a newly described clinical entity.[2]

Amies, in his study on surface film of swimming pools in 1956, reported:

> In a swimming pool the oral and nasal secretions of the bathers spread over the surface and are not dispersed in the main body of the water. Fatty substances derived from the skin and hair also accumulate at the surface and thereby contribute to the formation of a highly variegated and constantly changing surface film. Bacteria contained in these secretions remain in the surface film and are thus protected from the action of chlorine present in the water below.[3]

[1] J. R. Gallagher, Swimming Pools, Their Relation to Illness, *New England J. Med.*, *238:* 899–903, 1948.

[2] J. A. Bell, W. P. Rowe, J. I. Engler, R. H. Parrott, and R. J. Huebner, Pharyngoconjunctival Fever, Epidemiological Studies of a Recently Recognized Disease Entity, *J.A.M.A.*, *157:* 1083–1092, 1955.

[3] C. R. Amies, Surface Film on Swimming Pools, *Canad. J. Pub. Health*, *47:* 93–103, 1956.

It should be pointed out that the organisms recovered in Amies' study are those that are spread through personal contact in a population often without interruption. These organisms are normal inhabitants of skin and therefore would be expected in bathing water. The spread of these infectious agents through the vehicle of swimming water compared with other opportunities for the spread of these agents has not been evaluated. For further information on bacteria in swimming pools, the reader is referred to the studies of Stevenson [4] and Robinton, Mood, and Elliot.[5]

It would be well to consider the sampling of surface water in a pool. The above studies indicate that more attention should be given to the design and operation of effective skimming devices.

It is recommended that all scum gutter or skimmer return water be recirculated through the filtering system, instead of being wasted to sewer as it is now done at many pools. Not only will water cost be lowered by this, but it will eliminate the tendency for administrators or operators to view with horror the high cost of water going to waste. This leads them to request that the water level be lowered, which will result in improper skimming action. Lowering of the pool level should only be permitted during race events, when it is considered essential.

Discussion of the health aspects of swimming pools would be incomplete without some mention of one "disease" that can be directly attributed to a pool. This is accidental injury. The American College Health Association–National Safety Council joint report *Survey of Accidents to College Students* indicates that of injuries associated with athletics, swimming accounts for 2 per cent in males and 8 per cent in females.[6] An Illinois report states that the injury rate from swimming and diving under ideal conditions is 0.6 per 1000 exposures, or about equal to that for students sitting in a classroom.[7] The health services director should be alert

[4] A. H. Stevenson, Studies of Bathing Water Quality and Health, *Am. J. Pub. Health, 43:* 529–538, 1953.

[5] E. D. Robinton, E. W. Mood, and L. R. Elliot, A Study of Bacterial Flora in Swimming Pool Water Treated with High-Free Residual Chlorine, *Am. J. Pub. Health, 47:* 1101–1109, 1957.

[6] *Survey of Accidents to College Students*, Safety Monographs for Colleges and Universities, (No. 3, Chicago, Ill.: National Safety Council, 1955).

[7] Illinois State Department of Public Health, *Swimming Pool Operation* (Cir. No. N822; Springfield, Ill.: The Department, 1955).

in reviewing accident reports for the possibility of "epidemics" resulting from slippery decks, showers, or diving boards; improper supervision resulting in "horse play"; and other safety hazards.

One of the greatest needs in the development of environmental services is recognition of the necessity to refer to the environmentalist reports of injuries and communicable diseases, which may be related to swimming or to other hazardous environments and may be subject to preventive corrective measures. A complete health service program requires a record system and a registry that will reflect any increase in these kinds of problems. The collection of such data and prompt referral to a sanitarian would give the program the stature that is needed in providing preventive services. Without such facts (often first noticed by the laboratory), no preventive service can be sure of its accomplishments, nor can it concentrate its effort where it is most needed at a given time.

Health aspects of a swimming pool also involve the engineering or operational control. This includes such items as (1) design, (2) filtration, (3) disinfection, (4) maintenance, and (5) safety. An ideal program would include the training of swimming pool operators, and provision for the sanitation of dressing rooms and related environmental areas.

The design system is perhaps the most critical part in instituting a swimming pool program. Engineering studies are necessary in order that pipe sizes, pump capacities, filtration rates, and other factors can be critically analyzed in order that faulty design may be avoided. A properly engineered system, calculated to insure an adequate movement of all portions of surface waters to skimming devices and filters, can eliminate many of the problems involved in swimming pool operation, especially in regard to chlorination and bacteriological sampling.

When a new pool is being planned, the sanitarian should carefully review the plans and specifications to determine whether the items pertaining to health aspects are included. He should note its location in relation to shade and trees, determine if the pool decks are skidproof, and see to it that the scum gutters are not leg or arm traps.

The sides and bottom of a pool should be smooth. One reason, of course, is for ease of cleaning. Another is revealed in the studies

of Rees and Bennett in 1953,[8] more recently reported by Greenberg and Kupka in 1957,[9] on a tuberculosis-like disease associated with abrasion hazards; and swimming pool construction and sanitation play an important role in the prevention of this skin infection. Although these authors recommended break-point chlorination as having been proved to be effective in curtailing epidemics, more studies are needed to validate this premise.

Another important point to be considered in a plan review is that the pool should have an efficient filtering system in order that a so-called "polished" (a trade term) water results. All parts of the pool bottom must be clearly visible at all times—and this includes night swimming using artificial lighting. In the latter regard, will the pool have safe underwater lights? If not, where are the overhead lights located? If they are so placed that reflection blinds the lifeguard, corrections should be made.

With filtration, the old stand-by has been the pressure sand filter. If the new diatomaceous earth filter is desired for convenience, bear in mind that it requires careful operation. Another filter appearing on private pools is the "bag" filter. Any fraternities or student groups deciding to use one of these should be aware that, while inexpensive, they require more work to maintain.

Proper disinfection is of utmost importance when pools are in constant use and under heavy loading. Quality equipment is a must, and it should be of such capacity that a disinfecting residual can be maintained in the pool continually during swimming periods. Too often, after a class begins, the residual disappears, having been dissipated by agitation and sunlight. High chlorine residuals for algae control should be maintained in pools only intermittently during vacation and week-end periods, so as not to create resistant strains of algae in the water. This may result when 0.4 ppm chlorine is maintained constantly over a long period of time.

For small outdoor pools in which there is no continuous heavy load, studies conducted by the University of California indicate

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[8] R. B. Rees and J. H. Bennett, Granuloma Following Swimming Pool Abrasion, *J.A.M.A.*, *152:* 1606–1610, 1953.

[9] A. E. Greenberg and E. Kupka, Swimming Pool Injuries, Mycobacteria, and Tuberculosis-like Disease, *Pub. Health Rep.*, *72:* 902, 1957.

that residual chlorine levels are not necessary with adequate filtering and the maintenance of clear water. The use of clear water as a criterion for disinfection of outdoor pools requires, in addition to pH control, proper chlorination, but not the obtaining of a constant residual standard.

The plan reviewer should also note if the plans call for the old-fashioned foot bath in the pool shower room. Baer *et al.*, in their paper "Fungous Infections of the Feet," 1955, very aptly state our feelings.[10] "It is naive to expect that wading for a few seconds through a basin of antiseptic solution would help to prevent the transmission of fungous disease of the feet. These stagnating, unhygienic puddles should be abandoned." It should be mentioned, however, that the flowing-through or spray-type baths used to remove dirt from swimmers' feet are of value.

Other important areas of swimming pool safety, design, and operation can be readily found in the many standard references on the subject. Some of these are listed at the end of the paper.

The environmental service should insist that adequate records be kept on the operation of pools. These will reveal not only the "personality" of the pool itself (which each and every pool has), but also that of the operator. The presence of resistant strains of algae, the cause for a blue-green color of the water, and other similar points could be revealed by the record. Whenever there is suspicion that the pool water is involved in illness appearing at the student health service, the records should be checked to determine if there has been adequate chemical control. A group of patients with conjunctivitis may well reveal a high chlorine residual and a pH reading below 7.0.

Uses for a campus pool other than for recreation and competitive swimming are many and may include swim shows with various floating objects, crew workouts in the rowing scow (anchored securely), and other special events. Should trained sea lions be permitted to race or act in the campus pool? What does one recommend be done with a pool found to be bright orange, green, or purple in the early dawn, obviously from a prankster's dye? Or what does the health service recommend be done when a stu-

[10] R. L. Baer, S. A. Rosenthal, H. Rogachefsky, and J. Z. Litt, Newer Studies on Epidemiology of Fungous Infections of the Feet, *Am. J. Pub. Health, 45:* 784–790, 1955.

dent suicide is found at the bottom after the week end? Answers to questions such as these can be intelligently answered by a sanitarian only if he is aware of the fundamentals of pool operation and control. Each is a separate problem to be looked at differently. He should always be aware that in a campus environment anything is liable to happen! Good liaison with student committees and officers will greatly strengthen his position as a consultant.

Every campus and living-group pool should be operated according to the best attainable standards. In addition to health aspects, the university or college is an educational institution and its environment should be considered as a part of education for the development of future community leaders.

Swimming pools have not been demonstrated to be major hazards to health. Nevertheless, uncertainty still exists regarding many aspects of this healthy recreational activity. This uncertainty will continue unless physicians, co-operating with the sanitarian, develop a sensitive registry to record the occurrence of "disease" in controlled studies. It is true that in unsanitary pools organisms can be transmitted in sufficient numbers to cause illness. It is therefore good common sense to maintain campus pools and premises in a manner that will prevent the transmission of any potential infection.

It is concluded that the fundamentals for good health in respect to college and university swimming pools must include (1) a co-operative reporting system on health related to swimmers, (2) a more positive recognition of the environmental service in the planning stage of new swimming pools, (3) a program of supervision which includes training of pool operators, and (4) consultation and supervision of safety practices. The primary objective of a swimming pool operation should be clear (or call it "polished") water. As implied in this statement, chemical control is a part of obtaining such a standard.

The reader will find the following references give valuable information for the design and operation of swimming pools:

*Recommended Practice for Design, Equipment and Operation of Swimming Pools and Other Bathing Places*. New York: American Public Health Association, 1957.

*Operating Manual For Swimming Pools*. Elgin, Ill.: Elgin-Refinite Division of Elgin Softener Corp., 1954.

*Swim in Drinking Water*. Newark, N.J.: Wallace and Tiernan, n.d.

*Modern Swimming Pool Data and Design*. Elgin, Ill.: Elgin-Refinite Division of Elgin Softener Corp., 1953.

*Take the Guess Work Out of Pool Planning*. New York: Hoffman-Harris, Inc., 1955.